CHEMICAL
& METALLURGICAL
# ENGINEERING

Vol. 43 No. 2

THIRTEENTH ANNUAL REVIEW AND NEW PRODUCTS NUMBER—FEBRUARY, 1936

Price of this issue one dollar per copy.

Published monthly, price 35 cents a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3.00 a year. All other countries, $5.00 a year or 20 shillings. Entered as second-class matter July 13, 1918, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Member A.B.C. Member A.B.P.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 W. 42d St., New York, N. Y. Cable Address MCGRAWHILL, N.Y.

Branch Offices: 520 North Michigan Ave., Chicago; San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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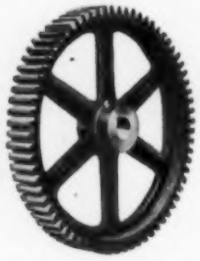

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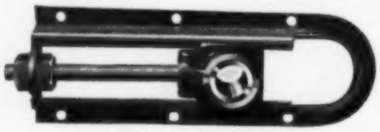

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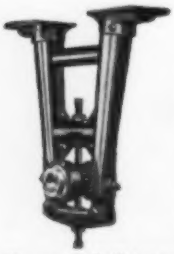

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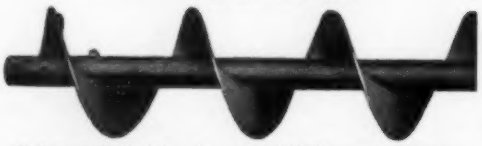

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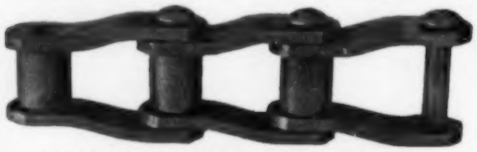

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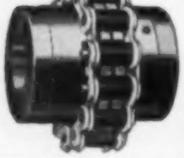

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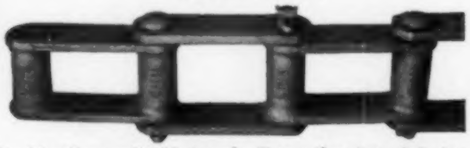

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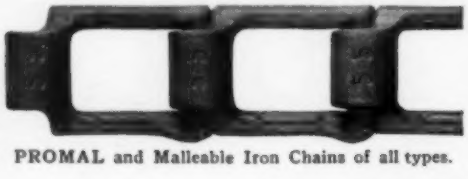

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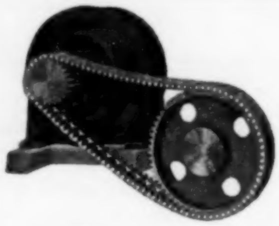

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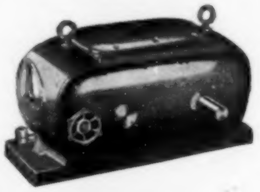

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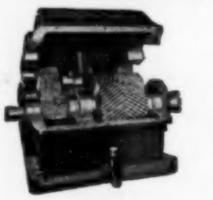

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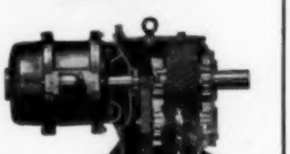

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CHEMICAL
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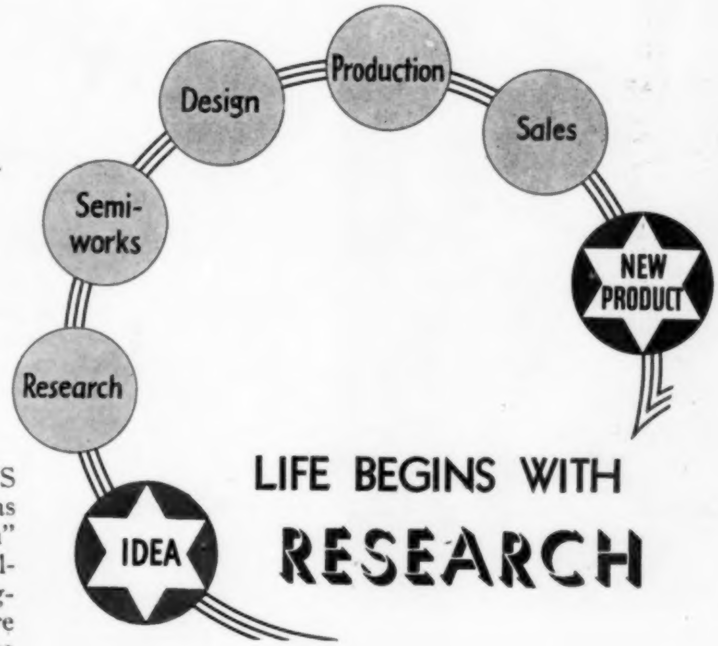
ENGINEERING

VOLUME 43 ESTABLISHED 1902 NUMBER 2

McGRAW-HILL PUBLISHING COMPANY, INC.

S. D. KIRKPATRICK, Editor

FEBRUARY, 1936



LIFE BEGINS WITH RESEARCH

NEW CHEMICAL PRODUCTS have been widely dramatized as the "Children of the Depression" and, more recently, as the "Children of the Recovery." That figure of speech becomes even more appropriate as we try to visualize the life cycle of these ubiquitous offspring of research. Skipping over the delicate question of parentage, let us merely say that the new product must have had its start in the germ of an idea in somebody's mind. It might have been anybody's, but the chances are it was the inquisitive mind of a research chemist. From there it developed, by fairly well understood processes which may or may not have their biological analogy, until it began to take on form and substance. Wealthy godfathers and scheming lawyers then appeared on the scene, speculating as to the future of the promising infant.

Rearing it through the diseases and other perils of early childhood, proves difficult, for high mortality rates are to be expected at this age. Soon, however, our new product enters the glorious period of youth, characterized by rapid growth and remarkable development. As maturity approaches, growth becomes less important, and other qualities and fields of usefulness appear. But with age comes heavier responsibilities, leveling off of further development and, finally, the inevitable decline to senility and obsolescence. By this time if industry is fortunate, another generation of new products has appeared and the work of the oldster is done. The life cycle is completed.

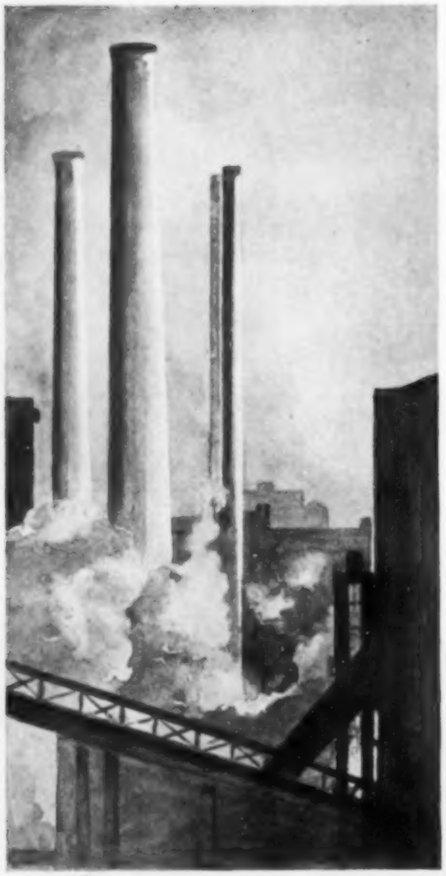
For chemical executives, engineers and chemists, there is something to think seriously about in this amusing analogy. That life cycle of the new product encompasses the whole field of chemical engineering activity. Where do today's products stand in the life cycle? Which of our industries are now in the youthful period of rapid and vigorous growth? Which are declining into senility and obsolescence? And what are we doing to stimulate and control the generation of products and industries that will inevitably displace those of today?

No other problem before chemical industry transcends in importance the vital necessity of planning and providing for a continuous stream of new products and processes. To move new ideas, plans and projects out of the research laboratories and off the drafting boards of the engineering department is an obligation dictated by the prime necessity for self preservation—if not today then certainly in the competitive struggle ahead.

Fortunately, those steps in this life cycle having to do with the development and introduction of new products in chemical industry have been fairly well established as a result of several years of successful experience. To present the story of this whole creative process in a helpful, constructive effort toward stimulating the further progress of the process industries is the primary purpose underlying this issue of *Chem. & Met.*—the thirteenth in our series of annual reviews of chemical engineering economics.

STEPS IN THE DEVELOPMENT

NEW PRODUCTS IN

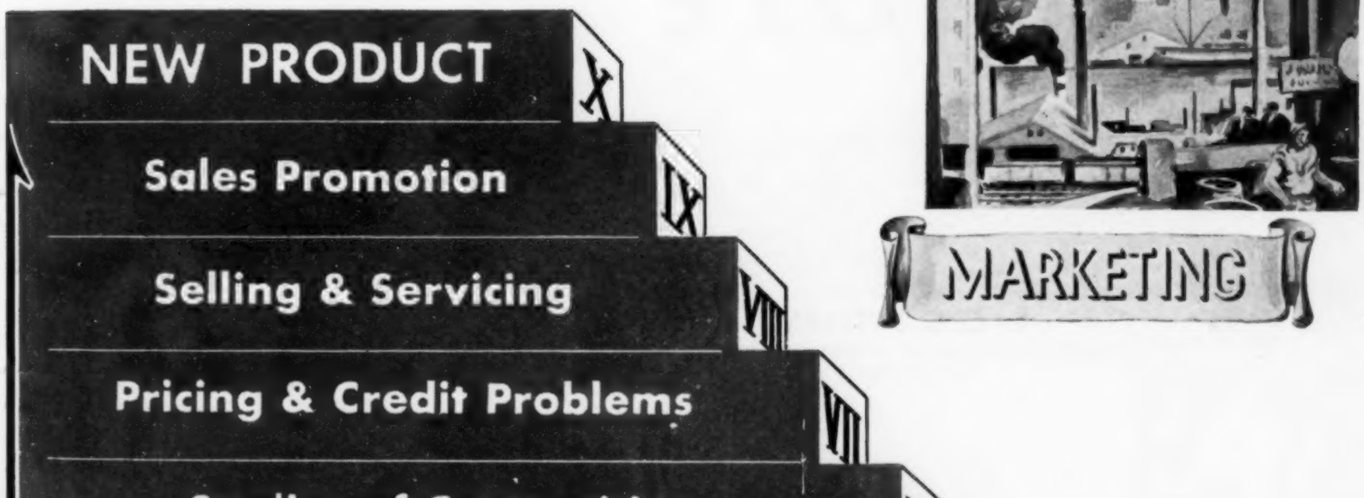


PRODUCTION

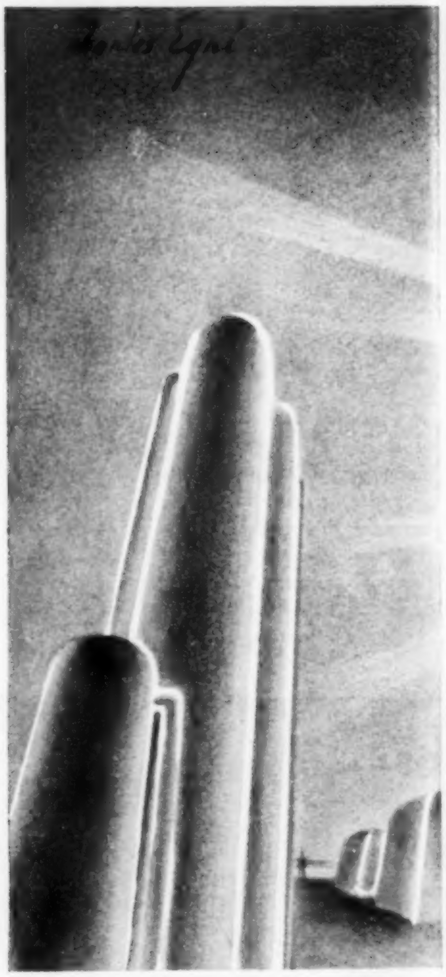
No decalogue of do's and don'ts is a safe guide to universal success in new-product development. But it is most important to remember, at the outset, that production and marketing studies must proceed simultaneously, step by step, toward the single major objective. Careful, critical analysis of all new plans and projects must be applied continuously, from the germination of the idea through all the complicating problems of technology and economics, manufacture and distribution, management and administration. Every man in the company

AND INTRODUCTION OF PROCESS INDUSTRIES

organization has a part to play somewhere in this creative process. No matter how logical is the planning, new-product development cannot always be expected to follow any fixed or arbitrary procedure. Rather, it is the responsibility of management to provide the flexible control and correlation of effort that will inevitably lead to decisive action only after obtaining thorough knowledge of all the facts. The day has gone for decisions based on executive hunch, sales intuition, or purely academic research.



CHEMICAL ENGINEER'S RÔLE IN AMERICA'S FUTURE



By C. C. FURNAS
ASSOCIATE PROFESSOR OF CHEMICAL ENGINEERING
YALE UNIVERSITY

"Versatile, scholarly, imaginative, resourceful, erudite, competent, well informed, widely read, visionary yet eminently practical"—these are some of the adjectives the literati are using in their praises for the brilliant author of the Book-of-the-Month Club's January selection: "The Next Hundred Years—The Unfinished Business of Science." No member of the chemical engineering profession is better qualified to give us this timely portrayal of the rôle of new technology in its future relations to industry and to the American public.
EDITOR

SINCE it has already been solemnly promised that we shall have successful television in a few years, it would seem that the electrical engineers' pioneering is about done. The mechanical engineers will close their frontiers with the widespread adoption of diesel motors for automobiles and the construction of "mechanical brains" that can outdo the professors of mathematics. Nothing *fundamentally* new has occurred in civil engineering for some time, there is no prospect that it will. There will be an immense amount of improvement in these fields in the future but the rough pioneering work is nearly finished.

With the chemical engineer it is different. His was a belated birth in the technical life of Mother Earth. He is just now coming of age and is looking to the unexplored horizons to see what he can acquire by right of conquest. But like all good colonizers he is not only going to acquire things,

Illustrated by CHARLES EGRI

he is going to give them as well. He is going to give a great deal more than he will receive. When he gets his new territory he is going to find the engineer's burden, social responsibility, pushed upon him. He is going to meet this responsibility with credit but it will be no simple task. It will be an immensely complex one. Glance over a few of the problems that are about to be thrown on the chemical engineer's broad shoulders:

Liquid Fuel. Geologists are again telling us that the petroleum reserves are good for only a few more years. Most petroleum technologists say its just another cry of "Wolf! Wolf!" Yet we must remember that the geologists have much more basis for being pessimistic than ever before. The surveys are much more complete than they were 10 years ago and as far as domestic supply is concerned we haven't very much to brag about. Within 10 years liquid fuels are going to present some interesting problems. It is a bridge that the chemical engineer is obligated to begin crossing before he gets to it.

Cracking, of course, was the first answer. Now comes polymerization to agglomerate the molecules of the lighter fractions to give something acceptable to our carburetors. But it is not enough. The question is not whether or not we will have motor fuel, but rather, how much will we have to pay for it. Is the complete answer in the hydrogenation of coal, in the mining of oil sands, in the utilization of oil shale or in the manufacture of alcohol? Alcohol can probably be ruled out of everything except politics but the main problem still remains to be solved. Can we stave off the day of reckoning by a process which will get *all* the petroleum out of the ground without having to mine the sands? It is of vital importance to the pocketbook of every man who expects to be driving a car 10 or 20 years from now, that the chemical engineer cross this bridge without too much delay.

Energy. Looking beyond the bottom of the gasoline tank, we may very well ask "What will be the ultimate source of energy for a high state of civilization after the coal is gone?" That's looking a number of generations ahead, but the problem is there just the same. When the sun shines it showers as much energy on the United States in 30 minutes as we Americans use in an entire year. If we could harness all the solar quanta that fall on 200 square miles of the Mohave Desert we would have enough energy for all our present national needs. Why should we ever want for sources of energy? Chemical engineers have

not yet begun to think of bridging the gap between a light quantum speeding from the sun and a scurrying electron in the winding of an electric motor; but they are obligated to think about it eventually. The answer lies in chemical processes. Chemists may point the way and blaze the trail. Chemical engineers must do the heavy work of perfection and adaptation.

AGRICULTURE. The greatest chemical factory in this country is spread over the 400 million acres of tillable land. The raw materials used are water, carbon dioxide, nitrogen, phosphorus, potassium, manganese, traces of other elements—and sunshine. The products are oxygen and an immense array of raw organic materials commonly considered to be solely useful for food or textiles. This factory, which has 10 million active workers, commonly called farmers, produces 10 billion dollars worth of raw materials annually. That is about $1,000 per worker-year. Almost any chemical plant on large scale production can turn out $10,000 worth of goods per worker-year; $30,000 per worker-year is not uncommon. For the process industries as a whole the value added per worker by manufacture averages about $5,000 per year. Several times this figure is attained in certain establishments. Compare these figures with the $1,000 per worker-year in agriculture. It might well be that these relative figures give a better explanation of the agriculturist's plight than do artificially maintained price levels or political abracadabras. Whether it wishes it or not, agriculture competes with industry. Industrial production per worker goes up and up, agricultural production per worker remains almost constant. How can the average farmer hope to be prosperous when he does not produce enough to justify prosperity?

Agricultural distress will never be permanently relieved until it is placed on a scientific and engineering basis. Is there anything to oppose a scientific basis for farming except the cussedness of the weather? Since farming is riddled with chemical processes (and unit operations) from beginning to end, the man in charge of the mammoth scientific farms (when we have them) will be some breed of chemical engineer, with botanists, entomologists and bacteriologists as first assistants. The productivity per worker will go up enormously. The number of workers in agriculture will go down tremendously. There will be shifts in population, there will be technological unemployment, more than that there will be the end of a time-honored way of life that has held our social structure together since we ceased being wandering herdsmen. There will be a social revolution, and the engineers will most decidedly be instrumental in it. Our future sky takes on a peculiar cast but it is time for us to begin thinking about the dawn. The least we can do is to determine ways and means of turning the revolution into evolution and keeping it painless and peaceful.

These things are a long way off. This generation (unless we find the Fountain of Youth) will not be much concerned in the mêlée. Yet year by year, more and more agriculture is going to move into the focal plane of the chemical engineering scene. Dr. Karl T. Compton, new president of the American Association for Advancement of Science expresses it thus: "The great problem in agriculture today is to discover new uses for products, uses which will create new social values or partially replace the consumption of our exhaustible natural resources. Silk from wood, rubber from weeds and motor fuel (alcohol mixed with gasoline) from corn and potatoes are actual examples of what can be done."

The writer would like to call Dr. Compton's hand when he holds to "motor fuel from corn and potatoes" but that is only a detail. The general idea is certainly sound. Farms are mammoth producers of billions of tons of raw materials. We can help agriculture and help ourselves if we can make those raw materials valuable by using them to satisfy human wants. We have made a start but, leaving ethyl alcohol out of the picture, our feeble efforts in this direction up to now would hardly buy the farmer another pair of overalls. It has only been a few years since the fermentation of corn to make butyl alcohol was made practical. Furfural, the liquid of many uses, has been extracted from oat hulls for only a short time. Henry Ford has some reactionary sociological ideas but he does look ahead in techniques. He uses the soy bean down to the last squeak by utilizing the oil for lacquer solvents, the meal for feed, the fibers for fillers. Wall board is being made from corn stalks and paper can be made satisfactorily from the same material. Cotton linters are used for the production of rayon but cornstalks could be used for that, too. There are about a billion tons of agriculture waste per year waiting for the chemical engineer to do something with them. Have you never seen acres of apple orchards with thousands of bushels of apples rotting because the market price would not even pay for the picking and shipping? What valuable thing can be made from the apples that no one wants to eat?

Turning to the functional side of agriculture, the chemical engineer doesn't want to be considered an irresponsible laggard. Plant fertilization in recent years has turned the corner. There is something more to fertility than the old triumvirate, nitrogen, phosphorus and potassium. There is bacterial life as well as the pH of the soil. Still more, there are the complex organic compounds called auxins that are definitely growth producers. There are compounds closely related to the sex hormones that serve the same purpose. When scientific farming includes the feeding of hungry plants with minute amounts of these highly potent growth catalysts, will the chemical engineer be prepared to produce the material in ton lots? What chemical engineer knows how to manufacture auxins? Suppose there should be a heavy demand for these substances in the next five years?

Even in the most luxurious corn fields the process of photo-synthesis is very inefficient. In the best cases only 2 per cent of the energy of the sun is stored in the plant. Perhaps proper use of growth catalysts would markedly improve this performance. There is going to be a call for tonnage manufacture of synthetic organic fertilizers.

FOOD. There is an enormous business (11 billion dollars) called food manufacture that really is not "manufacture" but "preparation." The industry still runs largely by rule-of-thumb and the chemical engineer has not had much of a look-in. But when the food industry really does take up "manufacture" the chemical engineer will, of necessity, be in on the ground floor. There will be food manufacture some time in the future for the simple reason that factories can be more efficient than plants and animals. Technically pure calcium phosphate costs about 8 cents a pound. In order to have sound bones and teeth we buy our calcium phosphate in minute quantities in milk, paying, on the

average with present milk prices, about $12 per pound for it. Some day we will manufacture at least a partial substitute for milk and we will have biologically assimilable calcium phosphate for much less than $12 per pound.

The protein of even moderately priced beef-steak costs well over one dollar per pound (dry weight). The protein of dried beans costs about one tenth of that. Can the incomplete proteins of beans be made as biologically satisfactory and as palatable as those of beef-steak? When they can be there will be an immense new food industry built up and the every-day foods of the average individual will be much less expensive and probably more wholesome than at present—and there will be a riot in the meat packers' lobby.

There are at least 7 vitamins that are necessary, not only for comfort but for life itself. There are often shortages of them even in good diets. As we enter an era of semi-synthetic foods it will be necessary to manufacture vitamins to round out our bill of fare. Already vitamin C can be made in considerable quantity in the laboratory but at a discouraging price per gram. Vitamin C may be called for soon in ton—or at least hundred weight—lots and at a reasonable price. It looks like a chemical engineer's job.

THE SEA. A few years ago a proposal to get anything but fish or romance from the sea brought only a smile. Now that the Ethyl-Dow company is producing ½ million pounds of bromine per month from the sea the smile is shifting toward the other side. Can we mine other elements from the same source? Gold from the sea seems to be one of the goals of mankind but its realization seems doubtful. How about some of the other metals? There are 2 trillion tons of copper in the oceans of the world. A healthy oyster will gargle as much as a barrel of sea water per day. In doing so, it concentrates copper from 1 part per million in sea water to 200 parts per million in its own body. What tricks of selective adsorption does the oyster know that we don't? After we have learned all that can be learned about selective adsorption from very dilute solutions will the extraction of metals from the boundless mine of the sea be practical? It is something for chemists and engineers to think about in their odd moments.

NEW PRODUCTS. Most of the preceding discussion has dealt with new and better ways of doing old things, but the world is not saturated with new things. The perfect plastic is not yet with us. Highways usually reach old age before their own bonds do. The necessity of painting frame houses every 3 to 5 years is almost maddening. Is Duprene the last word in synthetic rubber? At least not in the matter of price. We still have flat tires and the shelf life of rubber is distressingly short. Duralumin is the most satisfactory metal for airplanes, yet it is by no means satisfactory. Rayon still loses strength when wet, it is harsher than silk and wrinkles badly. No true synthetic silk has ever been made. Who will perfect the process for making wear-ever fabrics from ramie? Is there, just around the corner, any truly successful method for extracting aluminum from clay or other low-grade ores? Is there even a satisfactory artificial strawberry flavor?

The foregoing is no catalog of the future fields of activity of the chemical engineer, it is merely a hasty survey to outline the limits of the realm of chemical engineering probability. Some of the solutions await fundamental discovery and invention, others wait merely upon engineering development. Some of the developments will come soon, others only after a long time, if at all. None of them will come except after a great deal of hard work. You will notice that many of the items are introduced as questions to which no one knows the answer.

Over the whole background of this engineering existence there is the cloud of sociological effects. Probably if scientific and engineering principles were universally applied, 25 million people could be relieved of the necessity of living on farms. What would we do with the 25 million? When Germany began making artificial indigo, one million Hindus starved to death because there was no market for their natural indigo. Are we to solve our future socio-technological problems the same way? Will we continue looking over our bridges only after we have crossed them? To put artificial brakes on technical progress is unthinkable if not impossible but the questions still stand. Influential chemical engineers who will be directly responsible for some of the forthcoming developments might well put considerable thought on the matter, rather than leaving the thinking to politicians, for politicians don't think—at least not very often.

50 YEARS of NEW PRODUCT

By FRANCIS C. FRARY
and
JUNIUS D. EDWARDS
ALUMINUM RESEARCH LABORATORIES, NEW KENSINGTON, PA.

THIRTY YEARS passed from the time Oersted first isolated aluminum until Sainte-Claire Deville started the first aluminum works and made aluminum commercially available—at $90 per lb. The latter published a book, "De L'Aluminium; ses Propriétés, sa Fabrication et ses Applications," a surprisingly good resumé of aluminum and its uses. Here was a metal—very light, with the color and brilliance of silver, a good conductor of heat and electricity, and tarnish-proof. The uses to which it would be put were beyond imagination if—and only if—the cost could be reduced to cents instead of dollars per pound.

Another 30 years were to elapse before Charles Martin Hall, on Feb. 23, 1886, discovered an economical process of producing aluminum—a goal which many scientists had sought. Working from a new and brilliant conception, Hall discovered that alumina, a relatively cheap compound of aluminum, could be dissolved in molten cryolite and that the dissolved alumina could be electrolytically reduced to molten aluminum without decomposition of the stable cryolite electrolyte in which it was dissolved.

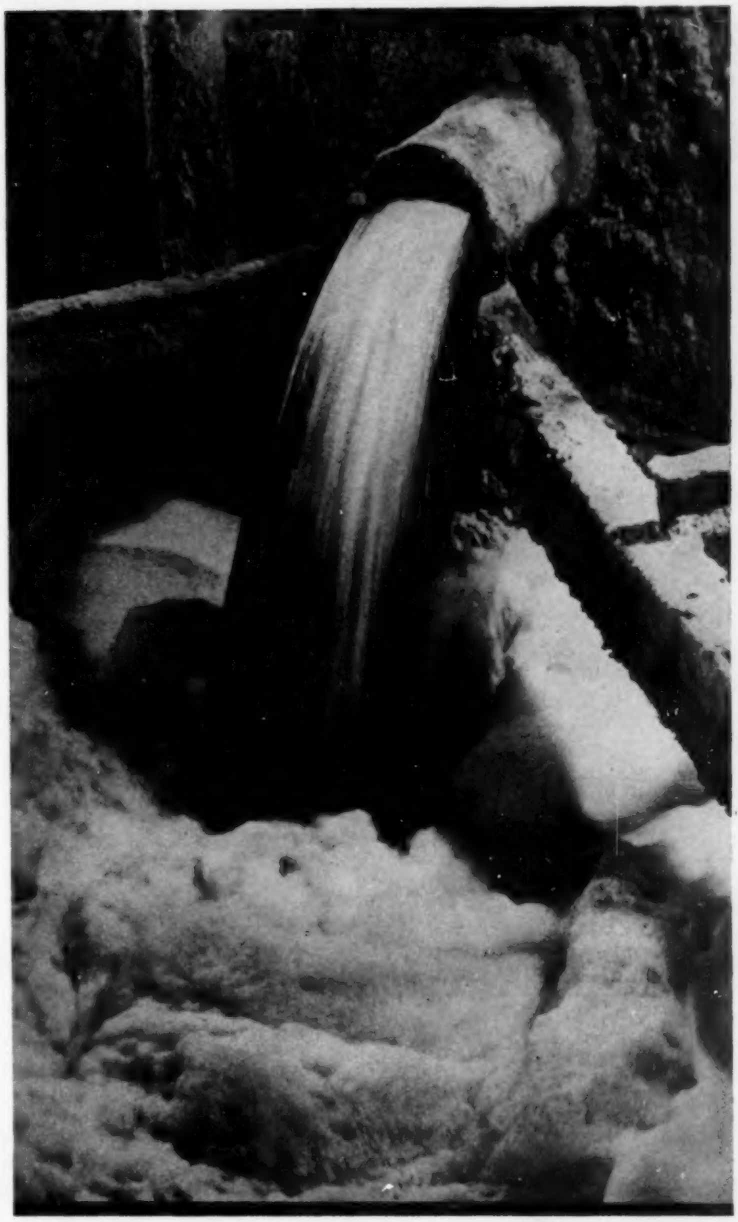
Hall's first experiments, in the family woodshed, were on a modest scale and with simple, home-made equipment; he had, however, unbounded faith in his process. Despite his frail physique, Hall seemed tireless in pushing the commercialization of his process. In the face of many discouragements, the Pittsburgh Reduction Co. (now the Aluminum Co. of America) was formed to operate his process, and production of aluminum was actually started in November, 1888. In a short time the company was selling aluminum for 50c. per lb. The goal was achieved—or so it seemed at the moment. But there was no rush to buy aluminum. The hundreds of uses to which aluminum was to be put seemed almost as far away as ever. However, Hall and his associates did not sit and wait for an aluminum-hungry world to make grooves in their doorstep. They clearly saw that to make a stable and growing market for aluminum they must teach people how to use the metal. They had made aluminum available as a commodity; they had now to make it available as a product, or rather, as innumerable new products.

Charles Martin Hall, who invented the present electrolytic process of producing aluminum just 50 years ago

To gain a clear picture of the industry at this point in its life cycle, one should consider what aluminum offered to the potential customer. Here was a metal very light indeed, with only about one-third the density of other common metals. It was a good conductor of electricity and heat, and was bright, non-tarnishing, and durable, but it was relatively soft and weak. Some backbone had to be put into the metal if it was to find extensive use other than for novelties. Like other metals, it could be stiffened and hardened by cold working, as by rolling and drawing. Sheet aluminum was produced in this way, and from it, many fabricated products. Cooking utensils were the most important of these, but such articles as trays, card-cases, paper-cutters, rules, combs and picture frames, to mention only a few, also were made and sold.

It was early found that the strength of aluminum could be increased by alloying it with other metals. There was no background, however, to guide alloy development; the wealth of technical information which we have today had not been dreamed of. The pioneers in this art had to make alloys by the "cut and try" method. Wrought alloys of aluminum with zinc and with copper were tried, but with limited success. The industry urgently needed alloys for many uses which demanded adequate strength, as well as the durability and lightness of the pure metal. To this problem metallurgists devoted themselves and soon found one answer in a new alloy to which was given the prosaic appellation, 3S. This was aluminum alloyed with about 1.25 per cent of manganese. The production and fabrication of this alloy, largely through the efforts of Earl Blough, was a real achievement. Its use in sheet, rod, tubing, and in almost every fabricated form, has grown constantly and it stands today as one of the most useful alloys available to industry.

DEVELOPMENT



Sodium aluminate solution from which pure aluminum hydrate is being precipitated

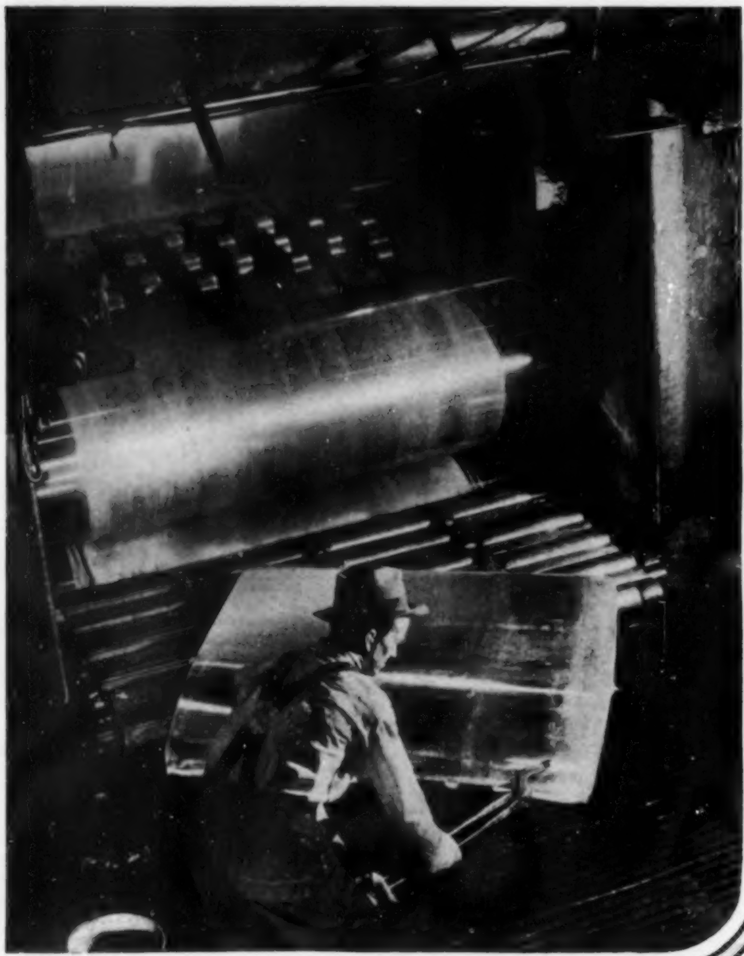
Photo by MARGARET BOURKE-WHITE

The alloy 3S gave cooking utensils a stiffness they had lacked, and utensils made from this alloy added greatly to the prestige of aluminum. Having gained this much ground, there came demands for still stronger alloys and the field was explored intensively; without, however, greatly increasing the limits of available strength and ductility.

About this time another great advance was made—the invention by Alfred Wilm of the alloy duralumin. This was the first and is still one of the most useful of heat-treatable aluminum alloys. Duralumin combined a tensile strength of about 60,000 lb. per sq.in. with an elongation of 20 per cent—properties which made it comparable with structural steel. Again the horizon for the application of aluminum had been extended. Wilm's invention greatly stimulated aluminum alloy research, which was now attended by phenomenal success. Now there is available a whole range of aluminum alloys, well adapted to the numerous requirements of the large number of industries served. Many of them are heat-treatable.

Twenty years ago, the development of a new alloy seemed a fairly simple proceeding. Once metallurgical intuition and persistent search had found a suitable composition and the technique of fabrication had been learned, the job was almost complete. Tests to establish physical properties were about all that remained. Today the problem of finding improved alloy products is more complex. To develop further old alloy compositions and find new ones, equilibrium diagrams of the metal alloy systems must be established and studied carefully. The goddess of chance may occasionally play a part in finding new compositions, but only the trained metallurgist seems able to recognize the lady at first sight. Once a promising alloy composition has been reached, an extensive study of its properties must be made. To the customary measurements of tensile strength, yield strength and elongation, must be added determinations of fatigue strength, not only by reverse bending, but in torsion, in tension and compression, and tests at both high and low temperatures. Measurements of creep resistance may be required.

Aluminum frequently does service at high temperatures, as, for example, in aircraft engines; also at very low temperatures in other parts of aircraft. For such applications it is necessary to know the whole range of physical properties of the metal at temperatures which may be as high as 800 deg. F., or as low as —70 deg. F. Other properties may have to be determined, as, for example, ease of machining, behavior in finishing processes, such as anodic coating, resistance to corrosion, and in some applications, its behavior in particular chemical environments. To this study is brought every instrument of science which can be helpful. They cover the range from the microscope and x-ray camera to the pyrometer, the spectroscope, and the analytical balance. Thus alloys are being developed which satisfy present require-



Hot-rolling of aluminum plate

ments and which, it is hoped, will anticipate many of the demands of the future.

Aside from the development of aluminum cable for transmission purposes, aluminum has contributed in many other ways to the progress of the electrical industry, as by the development of special wrought "channeluminum" bus bars, and of cast aluminum conducting bars and collector rings in modern induction motors. In an entirely different way it has contributed by being a constant spur to the industry to build bigger and better generators, transformers and rotary converters, to supply aluminum producers with the tremendous amounts of power required for manufacturing the metal.

More recently the aluminum industry has contributed substantially to the theory of design and the methods of construction of even the great dams required by modern hydroelectric works. As examples, we may cite the use of an "obelisk" to complete the diversion of the swiftly flowing Saguenay River and permit the finishing of the great dam at Chute-à-Caron (Dunn, C. P., Blasting a Precast Dam into Place, *Civil Engineering,* Vol. 1, p. 159, December, 1930), and the first complete experimental determination of the stresses actually produced in a concrete dam 700 ft. long and 200 ft. high, by the backing up of the water behind it. Subsequent development of a suitable material and method for building and testing a scale-model of this dam (Karpov, A. V., and R. L. Templin. Model of Calderwood Arch Dam, *Trans. Am. Soc. Civil Eng.,* Vol. 100, p. 185, 1935; also Building and Testing an Arch Dam Model, *Civil Eng.,* Vol. 2, January, 1932), which reproduced the same stress distribution, offers to civil engineers an opportunity to develop new and better designs and to test proposed designs for their efficiency. This opportunity has already been seized by the designers of one huge dam and will doubtless be appreciated by others.

Paralleling the high electrical conductivity of aluminum is its high thermal conductivity. This was soon found to be fundamentally important in the cooking utensil industry. If a thin iron frying pan, such as our forefathers sometimes used, is heated over an open flame, it is almost impossible to prevent burning the contents at some spots before they begin to cook at others. True, this can be avoided by making the utensil much thicker and heavier so as to give more opportunity for the heat to spread out on its way through the metal to the food. This increased weight, as illustrated by the old-fashioned pancake griddle, brought its own disadvantages with it. It would be hard now to sell such an awkward and heavy article to the modern housewife who has been used to the light aluminum ware.

Cooking utensils were one of the first extensive applications of aluminum. They have shown a steady growth in tonnage and over a period of years have consumed annually about one-eighth of the output of the metal. This excellent market situation has only been achieved by constant efforts, both to improve the product from the metallurgical and design standpoints, and to instruct the housewife in the care and use of these utensils. In the struggle for this market, suppliers of competitive materials were not idle. Fanatics also spread unfounded and ridiculous statements regarding the hygienic characteristics of aluminum. This campaign necessitated an extensive scientific study of the subject, which added much to our knowledge of the metal's properties and has shown the charges to be unfounded.

Another outstanding development employing the property of thermal conductivity, is seen in the motor-car industry. When aluminum pistons were first introduced, the main reason for their popularity was their light weight, which reduced stresses on connecting rods and bearings and permitted higher engine speeds. With the development of higher compression ratios in the engine, however, it began to be appreciated that the thermal conductivity of the aluminum piston was of great advantage, because it helped to prevent the carbonizing of the combustion chamber and

to carry away rapidly the excessive heat which was a cause of preignition or knocking. Finally it was realized that by the use of an aluminum head with its high thermal conductivity, the compression could be so far increased without "knocking" as to get considerably more power and efficiency from a given engine. The aluminum piston and aluminum head together thus make possible a significant development in the automotive industry.

Another important property of aluminum is its power of reflecting light and heat. The first striking development along this line was the discovery that the high reflectivity of aluminum foil and its low emissivity for radiated heat, could be used in combination with thin air spaces to form a superinsulator, 25 per cent better than corkboard, and with only a fraction of its weight. Experience with refrigerated rooms on vessels in tropical waters, and refrigerated truck bodies for transporting meat, etc., has shown conclusively the complete stability and commercial advantage of this insulation.

Within the last few years research and invention have solved the problem of the aluminum reflector for lighting purposes, and the solution may be aptly designated as "brilliant" in both senses of the word. An anodic electrolytic brightening treatment which raises the reflectivity of a buffed aluminum reflector from about 70 per cent to approximately 85 per cent, while fully retaining the specular quality of the original surface, and which then can be protected with an oxide coating that causes substantially no reduction in reflecting efficiency and is resistant to wind and weather, would have seemed a fantastic dream to the industry five years ago. The Alzak process is now doing this commercially to the satisfaction of the world's foremost lighting engineers. This, of course, opens up a new market for aluminum in a field where silvered glass or silvered brass formerly held almost undisputed sway.

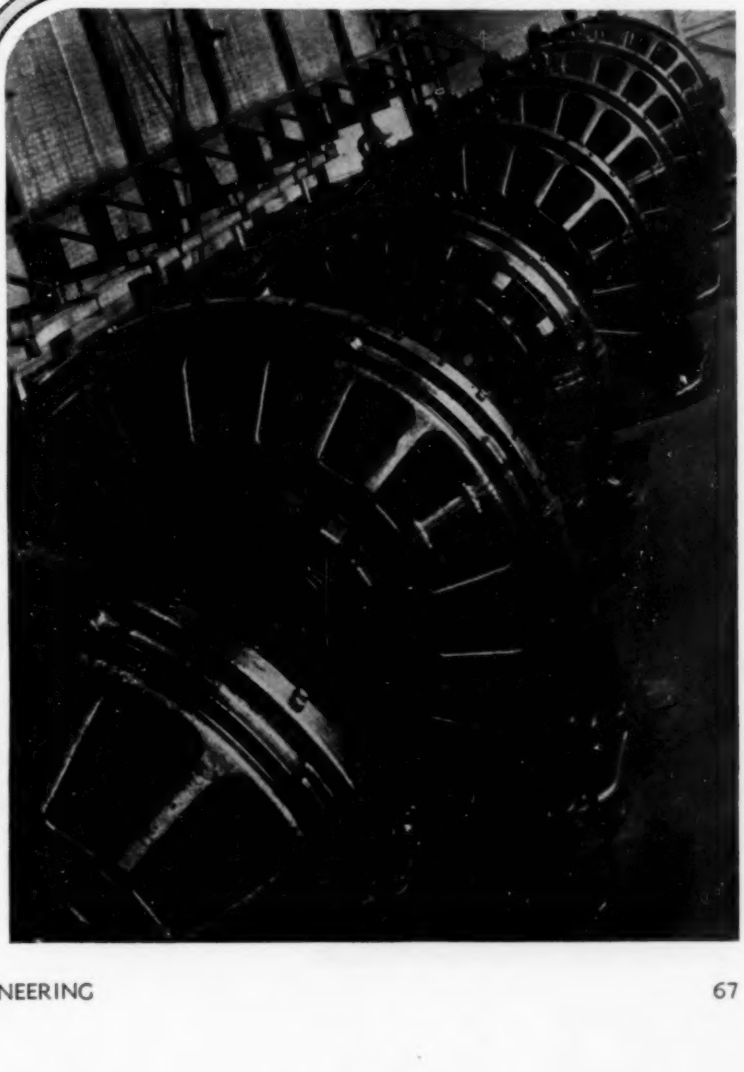
Early attempts to use aluminum in the construction of ships were unsuccessful because of lack of knowledge of proper alloys and design. The necessity of producing for "flying boats" pontoons which would have a reasonably long life as well as high strength and extreme lightness, led to a great deal of intensive research and development work. Progress was made in the development of more resistant alloys and in improved methods of protection by anodic coating and painting. The solution of the problem, however, was provided by the development of Alclad sheet in which a high-strength aluminum alloy core is given a thin coating of high-purity aluminum on its exposed surfaces. Recent improvements in the strength of the alloy core have increased further the serviceability of the Alclad products, while new combinations of core and coating compositions have extended their uses into other fields.

In the chemical and food industries, aluminum equipment has long been favored for certain processes and products because of its inertness and non-toxicity and the fact that its salts do not discolor any products in contact with it. For many years, only the highest purity aluminum could be used for such articles as tanks, barrels, etc., and the relatively low strength of the pure metal made it necessary to use comparatively thick walls. This made it hard for it to compete in cost with other higher strength products which offered similar advantages.

Recent development of strong, highly resistant aluminum alloys suitable for such sensitive products as beer and milk, has enabled the aluminum barrel and tank in this country to compete on favorable terms with other materials in these industries. Some of these alloys now bid fair to go into extensive use in the construction of hulls of small boats, and for partitions, deckhouses, and other structures of larger vessels, where their lightness and durability give them a great advantage.

Thus in its 50 years struggle to emerge from a jewelry store metal into the position of the fifth metal in point of tonnage, aluminum has passed through many stages of development; it has extended its influence into a variety of other industries, and it has proved its worth in competition with other age-old materials to the tremendous advantage of the public.

Rotary converters in aluminum reduction works

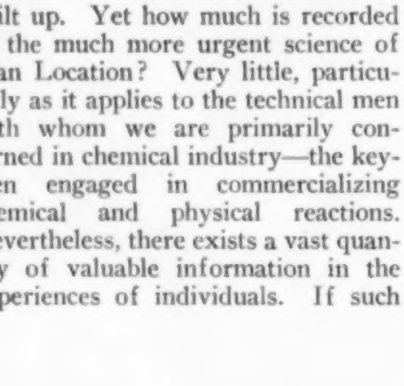


Photos by MARGARET BOURKE-WHITE

MAN

ONE OF management's most important functions in the development of a new product, and one which is frequently given a minimum of conscious attention, is that of finding the right man, for the right job, at the right time and place. In the whole of the commercial development of new products it is doubtful if there is another such variable factor as the human element. With the wrong man making preliminary studies of feasibility, or engaged in experimental research, or in economic or technical analyses, with a misfit in semiworks development, or in plant construction or operation, there is practically no limit to the good money that can be poured after bad, with only failures and lost opportunities to show for it.

Among what may be called the *inanimate* location factors of industrial chemical work considerable progress can be attested to. Whole sciences of plant location, process location (plant design), equipment location and market location have been built up. Yet how much is recorded of the much more urgent science of Man Location? Very little, particularly as it applies to the technical men with whom we are primarily concerned in chemical industry—the key-men engaged in commercializing chemical and physical reactions. Nevertheless, there exists a vast quantity of valuable information in the experiences of individuals. If such data could be collected and correlated, they would serve admirably to guide the growth of a science of human relations as applied to technical personnel.



Among the personnel types involved in new product development are several broad classifications encompassing, of course, a great number of narrower variations. The first type to engage us here is the man who can serve as a source of ideas for evaluation and, possibly, for a development program. The sources of ideas and the "methods" by which ideas are obtained have been considered at some length by various people. The main conclusions of such analytical attempts appear to be entirely sound and indicate that the source, of ideas are closely related psychologically to the association of previously known and practically proved ideas and facts. In other words, those men who have the most frequent worthwhile ideas are those who have had experience in other (perhaps unrelated) lines and possess the ability to correlate experiences and facts. Such men have logical minds and governed imaginations with which to separate the wheat from the chaff.

Ideas would, therefore, seem to be the results of a combination of knowledge, experience and training in logical thinking. Some men appear to have few ideas that are not sound and others to produce only "brainstorms." Those with the higher average of successes or good ideas are those with wide experience, a sound training and logical minds. They realize, moreover, that most ideas should be tested in conversations with selected individuals before a definite and expensive program is initiated.

The schools have much to do in the fundamental preparation of men, particularly as regards logical methods of thinking, but both they and employers have a responsibility in the further training and development of engineers. There is not, and there never will be, an "open sesame" to ideas but a conscious and real effort at thorough analysis of past experiences should be of immeasurable value. Such an effort can hardly fail

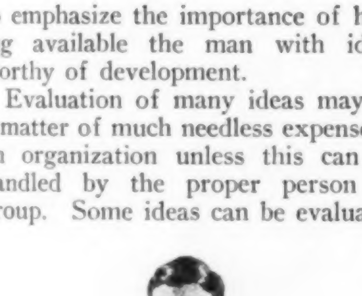
Illustrated by
T. BARRÉ

LOCATION

By JOHN H. PERRY
E. I. DUPONT DE NEMOURS & CO.
(GRASSELLI CHEMICAL CO.)
CLEVELAND, OHIO

to emphasize the importance of having available the man with ideas worthy of development.

Evaluation of many ideas may be a matter of much needless expense to an organization unless this can be handled by the proper person or group. Some ideas can be evaluated



in a short time; others frequently not without a considerable expenditure of time and money. A classical example of needless extensive expenditure is the time and money spent on the possibility of "hydrolyzing" nitrogen which Lewis has shown could have been predicted as a failure by rather elementary use of thermodynamic principles. On the other hand, all ideas submitted must have some consideration, both to avoid the possibility of overlooking a worthwhile project and to avoid the feeling among the personnel that their ideas are discouraged by cursory consideration. Selection of the group that investigates ideas requires great care both from the strictly economic aspect as well as that of organization morale.

The importance in an organization of the technical investigator whose duty it is to determine the feasibility and desirability of making major expenditures of time and money for research and commercial development cannot be overemphasized, nor the need for the best possible man in this critical position. His is the responsibility for the future technical and economic growth of his organization and, collectively, of the chemical industry.

Only a few of the characteristics of such an investigator can be mentioned. He should have broad knowledge and experience in order that he may be logical and impartial and neither unduly optimistic nor pessimistic. Youth, with its optimism and lack of experience, should generally be avoided here. An organization can well afford to place an older, more experienced, perhaps more expensive, man in direct charge of these studies. Under him may be placed some of the more promising younger men for further education and training. The technical investigator should also possess an intimate knowledge of the literature sources of information; a knowledge and appreciation of the prior art; familiarity with sources of pertinent production and use statistics; a knowledge of equipment sufficient to avoid recommending processes for which equipment designs may not be feasible; experience in research and in such economic lines as those of purchasing, manufacture, and sales; and the very essential ability to report accurately the results of his studies and his recommendations.

"A man out of his proper niche is the responsibility of the organization. Conversely, one properly placed is a decided asset."

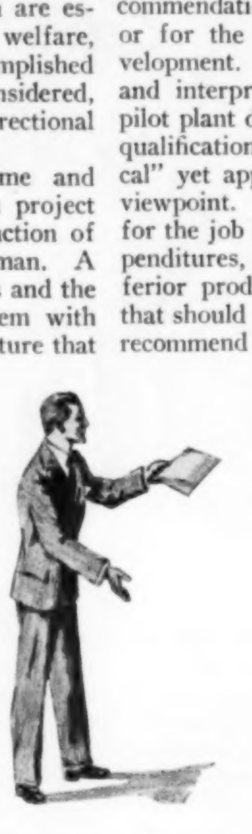
With the question of feasibility affirmatively settled, the idea passes to the research investigator, a man whose selection and further training should be a matter of considerable moment to the executives of an organization. In chemical industries, the research investigator is one of the principal sources of new ideas, products and processes. Reliance must be placed on his logic, accuracy, expert manipulation and judgment. His proper training and development in scientific and technical matters are vital but it is also necessary that he be trained in "organization - consciousness." The necessity of conferring and dealing with other individuals demands a man developed not only from the technical

side but from the personal side as well. He must have an appreciation of economics and of the ultimate goal: profit to his organization. Hence, his training and development and his proper location are essential to his organization's welfare, most fruitfully to be accomplished only under a carefully considered, continuous and consistent directional program.

What expenditure of time and money for a given research project is necessary is largely a function of the ability of the research man. A good one will produce results and the proper answer to his problem with but a fraction of the expenditure that a poorer investigator will require. Often, a poor research man will fail entirely to obtain the proper answer, drawing erroneous conclusions, and making faulty recommendation with resultant loss of profit and opportunity.

As an example of faulty research the case may be mentioned where several thousand dollars was spent on a detailed and complete research program looking toward the manufacture of a very corrosive material. A process satisfactory from the standpoint of thermodynamics and yields was developed in the laboratory. Only then was it found that no existing metal, alloy, or other suitable material of construction was available for fabricating a plant-scale compressor. Until such a material is developed, if it ever is, the money spent on this research will remain a total loss. Someone in the organization should have queried the matter of suitable materials of construction. If this had been done, a few dollars spent on corrosion experiments would have avoided the expenditure of thousands of dollars.

Supposing that the preliminary studies to determine feasibility and the experimental research program have indicated possibilities for a new process, the next step is a small-scale plant evaluation. The importance of the pilot plant in the commercial development of a new product can be emphasized by pointing out that the results obtained through its use are a bridge from the comparatively small expenditures that went before to the large ones to come later. Again the importance of having the right man on the job is tremendous. He is responsible for obtaining and interpreting results and often for major recommendations for a full-scale plant or for the abandonment of the development. The design, operation, and interpretation of results of the pilot plant demand a man of superior qualifications. He must be "practical" yet appreciative of the research viewpoint. If he is the wrong man for the job he can make excessive expenditures, lose time, make an inferior product, throw out a process that should be retained or, conversely, recommend one worth no further consideration. His results, it should be remembered, are frequently taken at their face value by the executives in their own analysis and recommendation.



The story is told of a major plant expenditure, involving several million dollars, that was made on the basis of pilot-plant operations. The yields and costs obtained in this full-scale plant were sufficiently close to those predicted. The quality of the product made had been satisfactory as made in the research laboratory, but the product of the pilot plant had not been tested. Impurities in the output of pilot- and full-scale plants rendered it useless for its intended purpose. A concentrated research program did not solve the problem and the plant and process were abandoned at a loss of most of the original investment. Had the correct man been in charge of the small-scale plant, a complete evaluation of its product would have disclosed its faults and would have saved the losses occasioned by the construction and initial operation of the full-scale plant.

Design and construction of many of our modern high-capacity chemical plants is a job of tremendous proportions and of enormous expense. How efficiently and economically this work is performed depends on the abilities of the relatively few men in direct charge. Such men must be cognizant of several location factors of industry: the location of raw materials, plant location, process location (in relation to other processes) and equipment location. All of these location factors are primarily dependent on man location.

The men in charge of the *operation* of a plant also have to worry about these same location factors. In operation, however, man location, itself, is possibly the most important matter for the management. Design and construction offer new items which keep men interested and awake; operating men do not have the same apparent diversity of items to hold their interest and to catalyze their imaginations. An operating man can frequently "hold his job" by performing his routine duties and grow old at the business without having done what could and should have been done. Frequent relocation of operating men can whet their appetites for their own development and advancement and can increase their interest in their jobs. These men, in turn, owe their subordinates a plan for their increased efficiency, development and advancement.

About $5,000 was spent in one case in developing detailed comparative costs of obtaining cooling and process water for a chemical plant. The decision made as soon as these estimates were submitted was that none of the methods was sufficiently economical for commercial use. A high-spot evaluation of the possible sources of water would have been sufficient for this purpose and a few hundred dollars should have been sufficient, saving several thousand dollars. Faulty design work in one or more parts of a chemical plant has more than once, at least temporarily, wrecked legitimate hopes for a profitable process. Other instances might be cited where poor design or construction caused abandonment of projects which actually were worthwhile ventures. Again the importance of the man-location factor, this time in design, construction and operation, seems clearly to be evident.

Nowhere is faulty man location more immediately apparent than in sales and sales service departments. Customers and sales accounts are frequently lost, either temporarily or permanently, through faults or failings of the sales or sales service men. These men are the ambassadors of goodwill—or illwill—depending upon their knowledge, ability and general deportment. Their outside contacts are more frequent than those of their

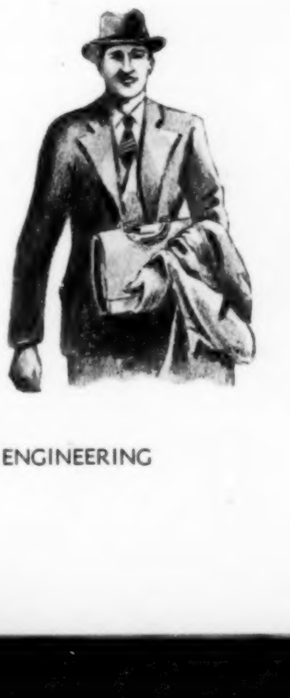
company co-workers and their abilities to retain old friends and to make new ones are among their gravest responsibilities. The customer's knowledge of other organizations is based to a very great extent upon his contacts with the salesmen who call on him. Honesty, the reputation of "being a square-shooter" and tact are possibly a salesman's greatest assets; without honesty, failure is inevitable; without tact, the required selling effort becomes useless or materially increased. It is imperative that the right man be in sales and sales service positions where the personal factor enters more pertinently and completely, perhaps, than at any other step in product development. Sales are being handled to an ever increasing extent by trained men. Latterly the chemical industry has begun to realize the necessity of a conscious analysis of men and their methods for these development steps.

Sources of active competition are usually not difficult to recognize. But it requires superior qualities in the man who can anticipate competition or recognize it in its earlier stages. New uses for old products and uses for new products constitute a fertile field for inquiry and are ever kept in mind by the more mentally active individuals. The training of technical personnel (and others) in recognizing and *appreciating* sources of competition, knowing the conditions and methods for meeting it and realizing when competition demands a new product (or a refinement of an old product) is possible today and is indeed demanded by industry. Men who have, at least partially, these characteristics should be recognized at the earliest possible moment, given additional training by contacts with better qualified men and offered the opportunity to determine if this field best meets their capabilities. The wrong man in such a job can be expensive; or even wreck a business. The right man can found an industry —if necessary.

The recognition of needs frequently calls for unique ability. Many times the average man will vaguely recognize a need but as often this knowledge will be unconscious and not actually recognized. An example was the need by pipe-smokers of some method of packaging cut tobacco in tins that would avoid cuts at the base of the fingers when loosening the tobacco in the bottom of the tin. This need was not actively recognized until the collapsible tin was invented. Many smokers were chagrined when this simple invention was marketed and the familiar exclamation, "why didn't I think of that!" was heard in every part of the land. Numerous similar examples might be selected from the chemical industries of needs that were only unconsciously realized and that eventually were met by new inventions of equipment or products. These fields of endeavor necessitate an appreciation for the right man and a program by which the desirable characteristics may be accentuated in individual technologists.

Technical men frequently have a single niche, and only one, in which they fit peculiarly well. Some men are especially adapted to manufacturing operations, others to research, sales, engineering, advertising, publicity, or other branch of activity. When a man fits best into research work for example, it is sometimes not realized that he may not have equal or better abilities along, say, operating lines. Few men seem to be capable in more than one line of endeavor. For the majority considerable observation is necessary in finding the type of work where their talents may be used most advantageously for their own welfare and the welfare of their organization and industry.

A man out of his proper niche is the responsibility of the organization. Conversely, one properly placed is a decided asset. In the interests of both economy and efficiency, a company can ill afford the expense and liability attaching to misplaced men; from the standpoint of the humanities, it is easy to justify careful attention to questions of job-fitting. Looked at from any angle, there is probably no single activity to which management can address itself that will be more profitable to everyone concerned, from stockholders to employees, to public, than this matter of man location and man development.



Hence this appeal is addressed primarily to the executives of chemical industry. To them their stockholders look for present and future earnings. To them their employees, both technical and nontechnical, look for guidance in their training and further education and in selecting methods and guides for their advancement. Sympathetic and patient cooperation and careful supervision of men will do much to assist them in finding themselves and in developing along the paths of their naturally endowed or acquired inclinations and capabilities. An investment in a serious and continuous program of development and improvement of men will provide a large return and will be reflected directly in improvements all along the line.

The results of jobs connected with commercial development are no better than the men who supervise them. Will the key men in future development be the products of chance and self-development or will they be super-technical men, evolved by a conscious, well defined, programmed science of Man Location? To everyone concerned—students, educators, subordinates and superiors alike—the matter is one for earnest thought and planning if benefit is to accrue to the profession and industry. Commercial development of new products and new processes is essential to chemical industry and in this the most vital single factor is man, whose development, like all developments, must be consciously planned. To the men in charge of each step in commercial development work are assigned two main duties: development of inanimate factors, which today are those principally stressed; and, much more important, the development of man himself.

SALES DEVELOPMENT

NEW FIELD OF CHEMICAL ENGINEERING

FREQUENTLY one hears statements to the effect that the big problems of today are those of distribution and marketing, whereas yesterday the big problems were those of production. If true, such statements would constitute an ideal text for a discussion of sales development. But there is much evidence that the problems of production are as complex as ever before in history.

Marketing problems appear to transcend those of production, because the "scientific method," long applied to production, only recently has been applied to marketing; consequently, there is much emphasis on marketing problems. Furthermore, a surprising number of so-called marketing problems actually are problems of production, or problems involving every function of a business. When sales begin to fall off, the production manager is tempted to point an accusing finger at the sales manager; and the sales manager in turn talks about increased "sales resistance." However, when sales resistance becomes the alibi for poor performance, it is well for the management to investigate the production department as well as the sales department. Usually the answer lies in improved performance by both departments, to say nothing of the possibilities of improved performance by such auxiliary departments as research, purchasing, traffic, and finance. After all, a headache is only a superficial manifestation of the deeper-seated malady, and so it is with the ills of business.

From the viewpoint of better performance by the sales department, sales development is gradually becoming a clearly-defined function. In the small company, the sales manager is a jack-of-all trades. He is the boss of salesmen; he passes on credits; he wrestles with collection problems; he keeps the sales records; he manages the advertising; he supervises the adjustment of complaints; in spare time he plans and develops new business. But in modern chemical industry a large proportion of the business is in the hands of companies sizable enough to warrant a fine division of functions, one of which most assuredly is sales development.

In this discussion, sales development is assumed to be the function which comprises the creation of outlets for products through the application of scientific or technical knowledge. Thus, sales development is to be distinguished from sales expansion by such direct sales effort as an increased sales staff, employment of better salesmen, or better management, or opening up new territory. Also, sales development is to be distinguished from sales expansion by sales promotion effort, such as advertising campaigns, and sales presentations for the use of wholesalers. Stated in another way, sales development is the pioneer sales effort as applied either to new products or to new uses for existing products. Sales promotion and sales expansion are the follow-up efforts of sales development.

The starting point in any sales development program is organization. Whether the organization comprises one man or a large group is immaterial; but it is essential that the man or men designated be not expected to handle sales development as a sideline or spare-time effort. The conduct of sales development requires undivided attention and a favorable atmosphere. Push a salesman and you may get increased sales; push a sales development man and you almost surely get trouble. Like the research chemist in the laboratory, the sales development man must penetrate deeply into the nature of things, and he must have patience. He must have greater technical ability, analytical ability, and imagination than the salesman. He must visualize new business and be able to transform the vision into results. All of this is not to convey the impression that sales development requires a higher order of ability than direct salesmanship. But a different kind of ability is required, and a different administrative viewpoint is required. Sales development is relatively a long-range effort, and results may not be secured in a year, two years, even more.

Considering the technical aspects of sales development, as well as the commercial aspects, such effort can be supervised either by the research department or by the sales department. For example, in the du Pont company both kinds of supervision are in operation, though a majority of departments conduct sales development under sales department supervision, in which case the necessary specialized technical assistance or experimental work is carried out by an adjunct staff, or cooperatively by the research department. Experience shows that the outside contact work which is so essential in sales development is, in general, better carried out under sales department supervision. One reason for this is that the typical research director is an incurable optimist, whereas the typical sales director has a skeptical viewpoint that provides a balancing effect.

Sales development problems originate in various ways, as for example the following:

(1) A desire to find new uses for existing products. Thus, every producer of such staple chemicals as sulphuric acid, ammonia, methanol, denatured alcohol, and silicate of soda is interested in achieving increased sales through new uses. Usually additional volume can be produced at an attractive "marginal cost," thus increasing the over-all profit, which at best is never large on such staple chemicals. Furthermore, existing outlets may diminish in volume or disappear entirely. Under these circumstances, sales development is justified merely as a form of business insurance.

(2) A desire to find uses for new products. Few indeed are the new products which are introduced without reasonable assurance of some definite outlet, if not outside the company, then within the company. But rarely is the initial volume of the new product so large that really low costs are achieved; thus additional volume is much desired. For example, the initial production of anhydrous ammonia by the du Pont Company was intended primarily for use within the company, specifically for oxidation to nitric acid and for other explosives and chemical purposes. Eventually, outside sales and sales resulting from new uses made possible a much increased output with consequent reductions in costs and selling prices.

(3) A desire to balance an operation by developing outlets for secondary products. Thus, at one time the demand for caustic soda considerably outstripped that for chlorine, throwing a surplus of chlorine on the market. Uses for chlorine were developed, and today it is understood that another type of process is in course of exploitation, which is attractive because it will yield chlorine from salt without a concurrent production of soda as such. (*Chem. & Met.*, October, 1935, pp. 537-8). In another case, a small proportion of new higher alcohols was produced along with methanol and these alcohols had only limited initial utility. Ultimately, outlets were developed which today are sufficient to warrant manufacture primarily for their own sake.

(4) A desire to satisfy a specific demand on the part of another industry. At times a customer will present a problem, the solution of which may involve a new use for an existing product, or will require that a new product be produced. These are special cases, often handled by binding the prospective customer to a requirements contract during such period as may be necessary in order to assure reasonable amortization of the plant.

(5) A desire to develop uses for a product, which by virtue of unusual properties should in some way find a place in industry. Manufacture may be started on a modest scale, on the theory that it should be a good speculation, even though specific outlets are not in sight. But a combination of desirable properties suggests utility, and every research laboratory is likely to stumble on these new products while possibly seeking something entirely different.

Publicity and Advertising

Publicity has a definite place in the sales development program, and if rightly used, publicity can be of great value in preparing the way for success. Publicity is merely the presentation of facts that are deemed by the press and its adjunct machinery to be of interest to a group of people. Once the facts are presented to a group, these facts are no longer news, and a repetition thereof is not publicity from the editorial viewpoint, but becomes advertising, and as advertising should be paid for. Unpaid advertising, or a rehash of old stuff is simply low-grade editorial practice and has questionable value, even to the supposed beneficiary of the "puff."

By CHAPLIN TYLER
ASSISTANT DIRECTOR OF PUBLICITY
E. I. DUPONT DE NEMOURS & CO.
WILMINGTON, DEL.

A recent example will show how publicity can be used as an aid to sales development. Some months ago the du Pont Company completed a plant for making urea in crystal form. While urea is an old compound and has been manufactured abroad for many years, its manufacture domestically and on a scale comparable with the existing demand is of suffient importance to enough people to be classed as news. However, any repetition of the same facts today would not qualify as news and would therefore be published as paid advertising. As this domestic urea industry develops, there are likely to be additional events, as for example, improvements in quality, expansion of production, price changes, new uses, all of which have news quality and are legitimate publicity. It all boils down to a simple principle: without an event there can be no news. Those responsible for sales development should consider the events within their own scope in the light of publicity. The world wants to hear about these events, and in so hearing, the foundation for possible sales will be laid.

After publicity, what? If the publicity is all effective, a tangible result will be inquiries about the new product or new application. The information usually requested in inquiries about new products relates to prices and terms; shipping point; time required for delivery; specifications and properties; containers; hazards to health and property; availability of samples.

At this point in sales development it is well to be fully prepared: samples should be available for immediate shipment; inquiries should be answered promptly, even though all the points may not be clear, or all the information at hand; descriptive material covering points of common interest should be prepared for enclosure with letters of reply. Failure to handle inquiries in a business-like manner is a good way to nullify the interest created by the publicity, and, incidentally, to create an unfavorable impression for the company. Fortunately, efficient handling of inquiries has its proper reward, if not in sales, in terms of good-will.

Another desirable follow-up of publicity is in advertising. Publicity is a statement of the facts as the press or other news agency chooses to state those facts, whereas advertising is (or should be) a statement of the facts as the advertiser chooses to state them. In advertising, such other factors as time of publication, space, and position are also under the advertiser's control, and for these privileges the advertiser pays a space charge. Ad-

vertising reaches many readers who may have missed the previous publicity, or it may serve to impress a message upon a reader through frequent repetition. While it is not the job of the sales development staff to prepare the advertising, or the publicity, these service agencies cannot be expected to function with full effect unless they have every desired help. Practically every case of poor advertising and publicity relating to new products or new applications can be traced to lack of coordination among the departments involved. Of what use is expensive and complex organization machinery unless it is operated properly?

Several years ago the du Pont company began manufacture of a synthetic wax. The introductory publicity and advertising were conducted on a modest scale, because there was no immediate expectation of large outlets. However, more than one hundred inquiries were received within a month, which is sufficient evidence that publicity and advertising will "pull" if the message is interesting, well-placed, and timely, even though the publicity may consist of only a few paragraphs, followed by several hundred dollars worth of paid advertising. To be exact, the out-of-pocket cost per inquiry received during the initial period of sales development was about three dollars.

Analysis of these inquiries showed that most of them should be followed up by supplying a small sample (several ounces) and a mimeographed statement of properties, suggested uses, and price schedule. In every case an individual letter was dictated, no matter how remote appeared the chances of making a sale. In these cases in which a favorable response was received from the follow-up by mail, or in which the inquiry appeared to represent an attractive outlet regardless of the response, personal calls were made. The proportion of these "live" prospects was about 20 per cent of the total inquiries.

Several interesting things will develop from the personal follow-up: In some cases the sales development representative will discern immediately that no further contact is indicated, as for example, because the prospective customer is operating a cats-and-dogs business and is unable or unwilling to give evidence of financial responsibility. In other cases it will be found that despite the prospective customer's verdict that the product is "uninteresting" or "out of line in price," this verdict was reached after cursory examination.

New products are generally referred to the "research department," which, in many companies, may be hardly more than a title appearing in the firm's letters. Under such conditions the sales development representative must decide whether to accept the verdict as a convenient means of avoiding further expense, or to render such technical assistance as he can in an attempt to demonstrate the fitness of the product.

In relatively few cases, the potential volume is sufficiently large to warrant technical assistance not only by consultation with the prospective customer, but experimentally in the seller's laboratory. The best-laid plans for sales development cannot anticipate all possible uses for a product; neither can these unforeseen uses be demonstrated without more or less experimental work. If the prospective customer is sufficiently interested, he will undertake such experimental work himself, and if he is at all competent in his field, he should be able to arrive at a verdict more quickly than an investigator who is not versed in the many practical aspects of the particular industry. Also, experimental work done by the prospective customer may lead to patentable results, which, of course, may prove valuable as a competitive factor. In any event, the sales development man cannot hope to become a research jack-of-all trades and thus submit to the prospective customer the answer to all and sundry problems. But at least he should offer the best possible product at a reasonable price, at the same time giving an accurate account of the principal physical and chemical properties.

Correlation of Properties and Uses

Like products suggest like uses; and therein lies a practical approach to sales development. For example, outlets for the synthetic wax mentioned previously were developed in part by such an approach. Investigation of waxes already on the market will disclose that there are a number of principal uses, as for example, for use in polishes, paper coatings, dielectric systems, candles, carbon paper, and cosmetics. It then becomes a simple matter to compile a list of manufacturers in these groups, thereby creating a basis for direct-by-mail approach. This is desirable, because not all potential users of a product will be reached through the initial publicity and advertising, just as not all potential users will be listed in any directory of manufacturers that may be available.

Suppose, however, that the problem is to develop new uses for a product that has no close counterpart in the industrial markets, as for example, anhydrous ammonia. Now, liquid ammonia has been on the market so many years that it might be supposed that all conceivable uses have been developed. However, new facts about ammonia are being turned up continually, and unless these facts are known widely, additional practical applications will not follow just as a matter of course. Furthermore, certain practical applications of old, well-known facts will not be developed until the price of the product is reduced substantially, or until certain matters of engineering have been more fully developed. Thus, liquid ammonia in tank cars at 5 cents a pound is an entirely different material from the economic viewpoint than ammonia in cylinders at 30 cents a pound, which was the price in 1925. Also, in the past few years industry has learned to handle ammonia in large quantities.

In the foregoing example, a continuing effort on sales development is justified, because the volume of existing ammonia sales is large, thus enabling considerable expenditures to be made without seriously affecting current profits. Also, because commercial ammonia is a definite chemical compound of high purity, a study of its properties is indicated as a guide to possible outlets. Such a study discloses that ammonia can be considered to be (1) a low-cost alkali, since only 17 lb. of ammonia are equivalent to 40 lb. of caustic soda, or to 53 lb. of soda ash; (2) the most concentrated form of fixed nitrogen, being 82 per cent nitrogen; (3) the most efficient commercial refrigerant; (4) an economical source of hydrogen gas, because when dissociated 30 lb. of ammonia will yield 1,000 cu.ft. of catalytically-pure hydrogen; (5) an interesting medium for a variety of reactions, which, with modern equipment, are readily carried out under pressure; and (6) an unusual solvent

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BUT IS IT FEASIBLE?

First and from the chemical engineer's view-point most important of five questions which management must answer satisfactorily before a new chemical product can be successfully developed and marketed.

IN THE NORMAL COURSE of the commercial development of a new chemical product, management finds itself face-to-face with five soul-searching questions or groups of questions, as follows:

1. **Is it feasible?**
2. **Will the process work in the laboratory?**
3. **What can we learn about it from semi-works?**
4. **What further information will be needed for large-scale process and plant development?**
   - **(a) Where are the raw materials?**
   - **(b) Where are the markets?**
   - **(c) Where should we build the plant?**
   - **(d) How lay out process and equipment?**
5. **Have we the men for all these jobs?**

In his article elsewhere in this issue, Dr. John H. Perry has proved rather conclusively that Question No. 5 is most important of all. It is naturally so, for "Man Location" holds the key to every stage of new-product development. But for the chemical engineer the greatest opportunity would seem to lie in answering Question No. 1.

A seasoned chemical engineer of broad experience and sound business judgment can sit at his desk and do more to promote the economical development of new products than perhaps anyone else in the company's organization. His only tools need be a sharp pencil, a slide rule, a few handbooks and reference works, and, of course, what he's got in his head. Even if such an investigator devotes his entire time for several weeks or months to the study of a single project, the expense involved would be only a small fraction of the subsequent cost for laboratory-research work, pilot-plant development, plant design and market analysis. If by preliminary feasibility studies it is possible to weed out the projects that could not possibly yield a suitable return on the investment in research and development, a tremendous saving is obvious. Less obvious, but perhaps not less important, is the saving that might result from proper choice of reactions, raw materials, or plans of market development.

Because of the importance of the preliminary feasibility studies in the chemical development of new products, we have asked Dr. Perry to give us a rather detailed outline of the factors which he feels should have consideration before the chemical engineer is ready to answer the question: "Is it feasible?"

OUTLINE OF PRELIMINARY FEASIBILITY STUDY

By JOHN H. PERRY

I. CONSIDER ALL POSSIBLE REACTIONS.

(a) List by classes or types and/or individual reaction, the reasons for or against the utility of each reaction or class of reaction.

II. RECOMMEND REACTION OR GROUPS OF REACTIONS SELECTED FOR LABORATORY INVESTIGATIONS—WITH REASONS THEREFOR.

III. ECONOMIC FACTORS FOR PRELIMINARY CONSIDERATON.

(a) Raw Materials.
- **Availability;**
- **Quality: presence or absence of deleterious or valuable impurities and their effect on use as crude materials;**
- **Quantity: present and future supply;**
- **Freight rates: to consuming points;**

(b) Thermodynamics of Reaction or Reactions With:
- **Summary of pertinent physical and chemical properties of reactants and products;**
- **Equilibria involved;**
- **Yields probable;**
- **Optimum conditions for optimum yields;**
- **Cost of raw materials per pound of product at probable yields.**

(c) Suitable Materials of Construction of Probable Utility.

(d) Markets: Uses of products (and byproducts)—
- **Present and possible;**
- **Extent of present markets with statistics.**

(e) Estimates of the Present and Possible Costs of Production of Principal Competitors.

(f) Probable Percentage of Present U. S. Production and of Imports that are Possible for Proposed Process or Product.

(g) Detailed Estimate of Production Cost of Proposed Product by Selected Reaction or Reactions.

(h) Sales and Sales Service—Customer Research.
- **Is cost of introduction likely to be excessive.**

(i) Shipping Restrictions and Containers.

(j) Effect of Storage upon Product.

(k) Safety and Fire Hazards of Raw Materials, Production Processes, Byproducts and Products.

(l) Estimate of Investment for Plant and Auxiliaries.

(m) Probable Profits.
- **Margin of profit per pound of product;**
- **Total profit probable under optimum and probable conditions;**
- **Probable return on the investment;**
- **Does it warrant further consideration and immediate experimental research and/or development? If immediate further development is not desirable, when and what change of present conditions are necessary or desirable before further development is attractive?**

(n) If Immediate Development is Desirable:
- **Outline questions to be answered, and facts to be secured by further research and developments.**
- **Indicate the crucial data and information that are lacking.**

(o) Plant Location.

IV. FINAL REPORT TO MANAGEMENT WITH COPIES FOR RESEARCH, PRODUCTION AND SALES EXECUTIVES.

APPLYING THE YARDSTICK OF

PRODUCTION COSTS AND

In the hands of a competent and experienced chemical engineer, carefully prepared and critical cost estimates based on accurate production data

IN THE DEVELOPMENT of new chemical products, the proper use of costs and statistics aids materially in reducing the risk of taking the wrong turn. The time when discoveries were wholly the work of a single individual has definitely passed. Development work as carried on today is rarely a one-man show. The great inventors of the past may have depended to a considerable extent on the following of hunches and whereas the hunches of genius are many times good guides, those of lesser men are more likely to lead to numerous and costly mistakes.

When a new product is proposed, the first and logical step is to take a preliminary look at costs of production and distribution. The ease of taking this step depends on the nature of the product and process and the background of costing experience of the investigator. The expense for raw material can be gaged with fair accuracy on an assumption of a reasonable yield based on the theoretical. When it comes to direct expense, it is usually possible to make a fairly intelligent guess, based on experience with similar unit operations or processes as carried on elsewhere in the plant on well-established products. Knowing the approximate output, and having a rough outline of the process, an experienced chemical engineer can make a crude estimate of plant investment. From such data a preliminary cost figure is set up.

If these preliminary studies indicate the feasibility of the proposed process or processes, the project will then be taken into the laboratory and, if still attractive, put through semi-works development. At each of these steps we can increase the accuracy of our cost estimates and before proceeding to the design of the full-scale plant, get a fairly close picture of final results and investments.

Suppose we look briefly at the elements in cost figures as commonly used in the chemical industry. First on the list comes raw materials; these may be purchased or of the company's own manufacture. If purchased, it is common practice that the cost of the purchasing department shall be spread over the materials bought. Some systems, however, place this as an indirect expense. In our cost sheet, of course, the materials should be valued as ready for use in the plant, and thus include any freight or handling charges previous to that point. With regard to materials of one's own manufacture, there is always the moot question as to whether they should be charged at works cost or at market value. It is believed to be the more common practice to follow the first method, as otherwise the product costs fluctuate greatly from year to year through no fault of the plant organization. Credits on raw materials or byproducts are put in at their value for sales or use, minus the cost of getting them to the user.

Direct expenses include a large number of items. No matter how small the production, a certain proportion of superintendence is necessary; direct labor, of course, is easily ascertained. In most large plants, steam is treated as a commodity, sold to the various departments at so much per thousand pounds, for it is almost impossible, if more than one product is manufactured, properly to allocate items such as fuel, engineers, and stokers. A common failing in many preliminary cost estimates is to show steam solely at fuel value. Power likewise, if of private generation, is sold to the various departments at so much per kilowatt-hour. If purchased, the method of charging is obvious. Repairs are usually handled on the basis of a repair reserve, a certain sum being charged to the department each month during the year, whether it is used or not, and the charge of the last month made to balance the actual expenditures. Since particularly in the chemical industry, large repairs take place at somewhat infrequent intervals, this system does away with wildly fluctuating noncomparable monthly costs. Fuel may be used directly in the process and is charged accordingly, and sometimes special items, such as refrigeration, are necessary. Every plant needs supplies, such as water, lubricating oil, belts, gloves, etc., and every cost sheet must contain items to take care of these expenditures.

Indirect Costs

When it comes to indirect expenses, items of taxes and insurance can be calculated directly from the investment and the local rate situation. Depreciation may be made to include obsolescence, or a separate amount for that factor may be included. In sizing up new products in this rapidly changing chemical world, too much care cannot be taken of the obsolescence factor, but necessarily that factor depends upon the circumstances involved. For depreciation on a new product it is probably unwise to figure on much less than 10 per cent on the capital invested and the leaning should be to more. Over and above these more or less easily calculated factors of indirect expense is the very important allocation of general works expense. Every plant must have roads, superintendents, office, guards, and machine shops. It is only fair that the cost of these

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MARKET STATISTICS

and marketing statistics are invaluable tools for weeding out many impractical and potentially unprofitable projects for new products.

general services be spread over all the products manufactured and a new product should ordinarily be capable of standing its fair share.

The addition of these three items, net raw materials, direct and indirect expenses, gives the works cost. To this must be added packages and filling and a general figure to cover the cost of selling and of general administration, including research. In the present state of cost accounting in the chemical industry, it is very difficult to get at the exact cost of selling an individual product, so that it is more common practice to figure the average cost of selling per dollar of sales and to apply such a factor to each product. This practice, of course, leads to obvious inaccuracies and can only be tolerated in view of the lack of much of anything better.

The final figure which the cost system should bring out is the percentage return on the investment, calculated by dividing net profits by the dollars of investment. So much for the costing system.

Coincidentally with this internal cost survey, the relation of the new product to outside industry must be ascertained. The amount sold now of the product itself, or its competing materials, must be determined and the industries into which it goes must be carefully studied. In the gathering of the statistics a good library is essential. The Census of Manufactures is of great aid in obtaining data on the better known products; the U. S. Tariff Commission Information Reports, and particularly the Census of Dyes and Other Synthetic Organic Chemicals, contain much information of importance in special fields. Statistics are available on imports and exports, from which may be judged the extent of the demand to be satisfied by domestic manufacture. Trade associations are continually publishing valuable pieces of information on output. *Chemical & Metallurgical Engineering's* annual review numbers are crowded with useful statistics and other data which aid in making up one's mind on a particular subject. Extremely important are personal contacts and the ability to obtain private information (which is sometimes, but not always, more valuable than that published) to show the situation on the characteristically waxing and waning chemical products of today.

We might, for instance, take as an example a proposal that an individual company should manufacture acetic acid. Our preliminary survey would indicate that acetic acid was made by the reaction of acetate of lime and sulphuric acid, by oxidation of ethyl alcohol or by synthesis from acetylene. The costs by the first method could be more or less readily estimated, since the two raw materials have well established prices and the process is simple. Again, the approximate cost of acetic acid from alcohol could be arrived at through known methods of oxidation. Given the acetylene, it would not be so very difficult to calculate cost of manufacture based on data already published. The cost of acetylene from calcium carbide would not be difficult to estimate. If, however, we decided to look at acetylene from methane, we would find a much more difficult situation. A rough market survey would show that acetic acid is increasing in tonnage. It would appear, therefore, that it might be necessary to make at least a partial investigation of acetylene from methane and we might assume that that was done in the laboratory, carried through the pilot plant, and final estimates made. With the knowledge in hand of the competitive methods, the market, the availability of raw materials, return on investment could be calculated and the final decision made.

Critical Evaluation

In making such a decision, enough stress cannot be laid on the necessity of a critical evaluation. Such questions as whether the manufacture of the product is in line with the policy of the company, should have been decided before any work was undertaken. In making the final check-up on a project, we should consider whether transferred raw materials should bear only an incremental cost—that is, if the plant for their manufacture is underloaded and this tonnage could not be developed except through the project under consideration, then in truly evaluating our proposition we should consider only the cost of raw materials and direct expense. Interspersed through our cost sheet, analysis will show a considerable amount of what we might call non-created overhead—that is, overhead which would be going on whether the proposed product is manufactured or not. In the cost of steam, of power, of water, and in general works expense, there is much of this factor. While we have put into our costs an established figure for sales expense, it might well be that the situation on the new product is such that selling expense will be either much less or much greater. It may be, for instance, that the product will go to only one or two large consumers on a contract settled once a year, or it may be that the product

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PUBLICIZING

THE NEW PRODUCT

Few men in chemical industry have had as broad and interesting experience as Dr. Hamor in the creation and successful commercial introduction of such a diversity of new products. A list of the "Children of Research" which he has had a hand in naming, publicizing and raising to industrial stature would read like a chemical guide book. Recently he recorded some of that experience and his resulting philosophy in the form of a booklet entitled "Whither Public Relations Work?" which was published by Mellon Institute in 1935. The following brief article is based on that most interesting publication.—EDITOR.

OUT OF THE EXPERIENCE of the past thirty years, which has covered almost the entire development of scientific management throughout industry, has gradually evolved a practical approach to the problems of introducing the new commercial product. If the product to be announced or publicized is a novel one and is the outcome of scientific research, the procedure that is systematically followed is briefly this:

1. It is essential, first to describe in the scientific literature, in an appropriate professional periodical, the investigation that has eventuated in the discovery or development. In this way the scientific world is told about the product before its announcement to the trade or trades concerned or to the public. By such a practice, information concerning the research and its creative outcome is conveyed first of all to the professional group whose members really decide upon the merit of such products and are coming more and more to control changes and purchases in general, both in the industries and among the masses of the people. Industrial scientists and engineers are generally anxious to secure all the obtainable facts regarding new products of concern to their companies, for transmission to buying officials; and they desire conservative, reliable descriptions of such novelties. Physicians want to know about new medicines. Engineers need to keep up with practical advancements in constructional materials.

2. Reprints of this contribution are procured for distribution to interested specialists and also for subsequent cultivation of a market.

3. Brief descriptions of the research accomplishment are prepared and sent to other periodicals in the field, for use immediately after the appearance of the main paper. In these condensates reference is made to the availability of a complete account of the investigation and its results (in the form of the reprint mentioned) to all interested persons upon direct request. Privately published bulletins, issued subsequently, can be announced in the same way.

4. Special articles are also written for journals in the trade field concerned. Often, immediately after the announcement of a scientific or technical discovery, invitations to prepare such articles come in from editors of interested periodicals.

5. Newspaper publicity is conducted immediately after the publication of the main or key paper.[1] At the time the latter is accepted by the editor of the journal to which it has been transmitted, it is learned when the paper will be published. Popularized stories are then written by specialists and sent to science editors, press bureaus, and newspapers for consideration for use after the date on which the main paper will make its appearance.

This procedure assures that the proper type of descriptive manuscript will be in the hands of newspaper editors prior to the publication of the scientific paper and that they will have for convenient use a dependable, plainly explanatory account of the research. If this practice is not followed in the case of a new product of public concern, there will be danger that the story of the achievement will soon be improperly told by outside feature writers who have access only to the less popularly phrased articles in scientific periodicals.

There is a demand for popularized scientific information; the publicity specialist does not have to create it. His responsibility and opportunity consist in providing accurate material in sufficient quantities and of proper quality.

6. Undoubtedly research on the product will be continued, to gain more information respecting its properties and uses. The factual information that is gleaned from this supplemental investigational work will be made available to the profession and/or trade concerned and then to the public, in accordance with the cycle outlined above.

Scientists and engineers are usually unversed in the art of dealing with public opinion and in non-technical literary work; hence all this publicity must be entrusted to specialists who can present facts correctly and interestingly and can foresee how the public will interpret them.

If a new product does not possess a research history—that is, if it is

[1] L. W. Bass and I have discussed broadly the subject of the newspaper popularization of scientific advances, in *Science*, 70, 632-4 (1929).

not the result of planned scientific investigation based upon a knowledge of existing needs or market requirements—and therefore cannot be the subject of a professional paper, the announcement of its commercial availability cannot be made so constructively in the systematic manner described in the foregoing paragraphs. In such an instance, the novel product will ordinarily be announced to prospective consumers through relevant trade periodicals and subsequently through newspapers and popular magazines. The point to be borne in mind is that it is essential to place a convincing story first before the "control group" for a given type of product and then before the public.

It is always a handicap, in industrial publicity, when a new product does not have a releasable story of research endeavor behind it. It must be pointed out here, however, that companies sometimes find it necessary to keep certain processes secret and hence may be loathe to divulge details of their production methods; this reticent policy, of course, may apply to some or all of the research novelties coming from their laboratories. But even in such cases, certain aspects of a new product can generally be treated in the manner outlined.

In other instances, systematic publicity is hampered by legal restrictions, imposed by the need for patent protection or at least favorable action in the Patent Office, before any particulars can be divulged to the public. If a research creation has impressive novelty and can form the subject of an interesting story, it is not always necessary, to insure trade journal or newspaper acceptance of articles, to be explicit regarding the process of manufacture. If a tanner wishes to announce the commercial availability of such a remarkable product as "self-shining" leather, and does not desire to publish any facts concerning the method of producing it, he and his publicity aids will nevertheless find a receptive trade and popular press. Descriptions of uses of new products whose composition cannot be disclosed are sometimes infused into addresses or their discussions at meetings of trade associations whose members are interested in such developments.

Chemical stories of the industries are in general more appealing to the public than physical or mechanical tales from a similar source. The public is particularly interested in new remedies, foods, detergents, textiles, and constructional materials that have required protracted scientific study to evolve and whose merits have been proved by technical trial. But popular information on new heating appliances, furniture, wearing apparel, and household fixtures can also elicit responses.

Coordinating Advertising and Publicity

The most influential medium in the improvement of public relations has been the advertising agency, although the trade association secretariat and in recent years the public relations departments of various companies have had active rôles in this development. At the time of the Civil War, there were only thirty advertising agencies in this country; twenty years later there were fifty such firms, and now there are about 2,000. Many of these agencies have evolved deft techniques for advancing the broader public relations interests of their clients, in addition to carrying on advertising programs.

At present advertising and publicity are generally regarded by industrial management as two closely related but distinct forces in the field of public relations. As applied, to yield effective results, these forces must be coordinated. Advertising is basically a force for the promotion of sales. Publicity, as usually carried out, is essentially educational in character. The fact that some present-day advertising is informative in nature occasionally complicates this picture in the minds of certain publishers and business executives. Publicity should never take the place of advertising. Its ordinary sphere is to acquaint the public with new discoveries or developments of interest, so as to erect a background of information that can later be made to yield sales through advertising and other promotional activities. In addition, publicity is of utility in neutralizing or subduing sales resistance, especially misinformation and prejudice; new customs, vital elements in market cultivation, can thus be introduced by arousing interest in their novel features and then a vogue therefor.

Among the other benefits to the industries that are derivable from publicity is the dissemination of good will by the release of interesting and favorable facts about a business and its policies. If a company is conducting scientific research with the aim of improving its products, this fact is of concern to consumers, and it is the special province of publicity to acquaint the public therewith. If a company has leadership in its management methods, the publication of that fact, in an interesting way, will add to the status of the organization among consumers. It is plain that a business may be made or marred by the method and manner of its publicity.

If it is desirable in an undertaking to convey important news to the trade or the public, the competent publicity specialist can devise a situation that will have adequate appeal to carry a story containing such a message. These specialists must be on the alert to take advantage of events of general news interest, to the advantage of their clients or employers.

By
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Sales Development
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of possible use in purification processes.

Similarly, any product can be considered in the light of its properties, in order to approach the sales development problem in a real fundamental way. If, like ammonia, the product is a definite compound, various chemical reactions likewise should be considered.

Another aspect of sales development work is the hazard relating to the handling of certain products by the customer. Of course, in so far as hazards are definitely established, safety measures or regulations have been promulgated. But regarding toxicity in particular, chemical developments are coming along so rapidly that it is difficult for toxicological science to keep well up to date. Because of this situation, producers of new products, and those seeking to extend the use of existing products, should proceed cautiously when doubt exists.

IT'S everybody's job according to this eminent authority who has collaborated with us in the preparation of the two check-lists of questions that appear as an editorial supplement to this issue of Chem. & Met. **May we suggest that they be carefully studied in connection with this article which gives an unusual insight into both the production and marketing problems involved in the successful development and introduction of the new chemical product?—EDITORS.**

WHO'S RESPONSIBLE?

FOR NEW PRODUCTS

By O. C. HOLLERAN
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U. S. BUREAU OF FOREIGN AND DOMESTIC COMMERCE
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BUSINESS of our day has become so complicated, so vitally affected by such a great number of diverse problems, that no business man, however wide his experience may be, is capable of making all of today's decisions. The old system of combining executive experience, feminine intuition, and gamblers' hunches to reach a decison on business questions is past.

It is no longer necessary to justify the need of complete advance planning for the introduction of a new product. During the past ten years such planning has become more and more common. Unfortunately the very speed of its acceptance has led to great inefficiency in its application. Various departmental chiefs still consider their functions as being independent of the functions of other sections of their company. The result is that company funds are often wasted simply because a new product is thrown on the market without the benefit of a completely coordinated survey of the entire production and marketing problem prior to the beginning of the production and marketing effort.

Right at the beginning it should be understood by everybody in the organization that the job of originating ideas for new products does not lie in the hands of any single individual or department. Ideas come from every direction. Many of the best of them come from distributors and from the consumers themselves. These ideas are the reflection of an already existing demand for means to meet an active problem. A great many ideas come from the trade and technical literature and from independent inventors. Naturally, however, the bulk of ideas for new products come from the manufacturer's own staff. Consequently every member of that staff from the president to the plant errand boy is potentially the source of a profitable new product idea and should always be encouraged to think along these lines.

The idea having been obtained, the first step is the management's appraisal of that idea, primarily to answer the question—why should we make this new product? The answer to that question will fundamentally control the entire activity. For instance, if the product is to meet a new need of the market or to expand sales in the present market the entire treatment, production plans, selling and advertising plans, differ both in method and in cost from the handling of a product designed purely as a means of taking up the idle time of plant equipment already in place. This is immediately obvious, since in the first case large sales, wide distribution, and decided profits are the objective of the new product; while in the latter case if sales are sufficient to keep the machinery in operation and stabilize the plant's payroll and overhead during the seasonal idle period, the project may be satisfactory even though the profit and loss sheet shows that nothing in actual cash has been added to the company's income by the activity.

Once the reason for the product's existence is settled by the management, the preliminary feasibility studies become particularly important. These are essentially matters of getting off on the right foot and avoiding costly changes in process and equipment after production is under way. But as pointed out in other articles in this issue, important economic as well as engineering factors must be studied.

Most raw material problems are often overlooked in the early stages of planning and arise later to plague the project. Just prior to the World War one or two chemical manufacturers suffered great losses because they had not built up inventories of certain imported raw materials against the approaching emergency, although it had become obvious that there was great danger of being cut off from their regular sources of supply. The result was costly. Location of raw material sources; the size of inventory

which must be maintained; what can be used for substitutes in the event of a sudden scarcity of supplies; and what effect these things will have on the cost of production and cost to the user; as well as the efficiency of the product itself; must all be carefully studied beforehand.

The research, development, and engineering studies which so many times are considered as entirely separate from marketing studies are in many ways more important as marketing problems than as purely production problems. Production costs are reflected eventually in the cost to the customer and therefore may be a big help or a sad burden on the marketing effort and marketing cost of the company.

A couple of years ago a chemical manufacturer brought out a new product of very considerable marketability. It appeared from the pilot-plant experience that this product would fit well into the regular schedule of the company. Unfortunately there was a failure to take into consideration the variation of market demand for other products of the company as well as the schedule of their manufacture in the plant. The result was that the new product, which proved decidedly popular, soon created a general production jam in one of the company's plants with a consequent chaos of delayed deliveries and extra costs. At the end of the first year, instead of showing the healthy profit which it should have done and which its sales full justified, the new product actually showed a five-figure loss for the manufacturer.

Storage and packaging present double-barreled questions. Primarily the type of package to be used must be decided by the plant engineers. They are the ones who must decide whether the package should have special strength, special lining, and special types of closure. On the other hand the sales promotion or sales executive should make the decision as to the general size of the package and its outside finish. The sales promotion group is interested in having packages of a size to meet the market demand and a finish which will be attractive and will instantly identify the package as coming from the company. Incidentally, it is always well for the sales manager to have an opportunity to consider every package closure before its final adoption. The plant engineers may develop a most efficient means of sealing a package, but the sales manager must always keep in mind the problem of how great an obstacle that seal will be to opening the package for use. "Too hard to open" is a decided handicap to sales.

Service problems are also as much a part of the production study as of sales because in the final analysis nearly all service questions go back to the plant for answer. At least the basis of the service plan must be ruled by production policies. In many of the process industries, it is habitual for the engineer-salesman also to service the merchandise. Even then much of the service depends on the plant so that the answers to these questions must be worked out as a common interest of both production and marketing.

The various problems having to do with the relation of the new product to the regular line are important in every case and under some conditions become vital to the success of the marketing effort. For instance, a manufacturer of heavy chemicals designed primarily for acid and fertilizer use would find himself handicapped in bringing out a line of fine dyestuffs for use by silk finishers simply because there would be a tendency on the part of the customer to feel that his previous chemical experience did not indicate a sufficient technical knowledge of the new field. It should always be remembered that if the new product is to be widely different from the regular line, the market must be educated to the manufacturer's ability to meet the requirement of the market which will absorb the new product.

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If you're interested in the commercial development of a new product—and what chemical engineer isn't?—try your hand at answering the 300 questions on the eight-page wall chart and checksheet that appears as an editorial supplement to this issue of Chem. & Met.

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When we consider the marketing problems involved in the successful introduction of a new chemical product we must immediately change our entire approach from that assumed in the study of the research and production phases. In the first place we have the questions—what industries will use the new product, the size of each of these industries, and the quantities of the product which they should use. With this information available, we have a picture of the entire potential market. Great care should be taken, however, to ascertain if all of these industries are within reach of our selling organization. It is entirely possible for an organization to picture a market of national size, only to find, after having spent thousands of dollars in preparing to enter that market, that a great part of it is located at such a distance from the normal field of operation that it could only be covered at a selling and service expense completely out of line with the possible profits.

A pertinent example in a process industry was a case which occurred some years ago when a certain Eastern paint manufacturer landed what appeared to be a very fine contract from a Michigan firm. He soon found that every gallon of paint he was selling represented a healthy loss because of the number of trips his service men were forced to make in order to take care of the account.

Another extremely important factor in the measurement of the market lies in studying the buying habits of the proposed customers. Such question as: who does the actual buying, number of calls which are needed to secure the acceptance of a new product, the amount of time involved between first contact and final acceptance; will all have a direct effect on the sales cost and therefore on the price of the product itself.

One of the very interesting experiences which a sales manager sometimes has is finding that his own company will absolutely refuse to buy merchandise on any terms except those habitually used in the industry, yet will require him to go into his selling field and attempt to persuade potential customers to accept discounts, allowances, and terms utterly different from those to which they are accustomed. Any such attitude will put an extremely severe, if not fatal, handicap on sales.

Another group of questions, many

of which overlap the buying habits of the market, are those concerning the manufacturer's own relation to the market for a new product. It might well surprise some of the largest manufacturers in the chemical industry to know that there are industries in this country in which their names are scarcely known. Consequently, it is necessary that careful study be given to the problem of just what is the manufacturer's reputation in the market expected to use the new product. With the facts before him he can safely answer these questions: Must he indulge in a super-expensive sales promotion campaign to convince his new customers of his size, dependability, or other qualifications? Must he spend funds needed for other purposes in creating a reputation for the new product in a market where he is already known, because the product is radically different from anything he has produced before? Case after case of marketing failure could be cited, particularly in the chemical industry, because the manufacturer assumed his standing in a market instead of finding the facts before he acted.

Now let us look at questions of competition. Even if the new product is so radically different that there is no immediate competition there is still the necessity for a very careful survey of potential competitors. If competition already exists, either from a similar product or a different product, the importance of the competition study increases many-fold. Perhaps the four most important of the competition questions are these: Is the present line vulnerable to new or keener competition in an already highly competitive market? Will the introduction of the new product create such new or keener competition on the regular line? Examples of new products introduced to the detriment of other manufacturers which resulted in retaliatory products to compete with the original line of the manufacturer are too common to need citing. It is an ever present danger and great care should be taken in surveying the situation, to be prepared for any eventuality.

Will the introduction of the new product compete with the product of one or more important customers of the manufacturer? Just a few months ago, one of the larger chemical manufacturers of the country produced a new product of really great value to the final consumer. Unfortunately, the use of this product by the final consumer would tend to cut a very large percentage from the present sales of the product now used for this purpose. The present product is being sold by a processing group which uses a huge tonnage of the chemical manufacturer's merchandise in several other fields. If he goes on with the marketing of his new product, obviously he is almost certain to lose the present market for a large part of his regular line. That situation is one of the commonest facing the chemical industry because of its well-known inter-commodity and inter-process competition. Some of the apparently quick shifts which occur in the industry would not look so unusual if the full facts were known.

In the chemical industry, more than in any other of the great basic industries of the country, the time element in the marketing of a new product is important. Changes occur so rapidly that practically no product is insured of any permanence of profitable life. Consequently, marketing questions must be accurately and efficiently handled from the inception of the effort. There is no time to correct errors or to regain profits lost through market ignorance or market misjudgment.

Problems arising in the organization of the sales force are a continual source of trouble. Where the new product is concerned it is important to decide at the beginning whether technical men are needed to sell the new product. If the product itself is so standardized that it is not subject to change and if the market is willing to discuss such merchandise with a non-technical salesman, it would be unjustified expense to sell the merchandise through a high-priced engineering sales force. If the opposite situation exists, it would be still more expensive to attempt marketing the new product with non-technical salesmen. While all of the decisions necessitated by this group of questions are basically important, certain of them stand out because of the constancy with which they have been neglected in the industry until the neglect appeared in red in the profit and loss statement.

Finally there is the general grouping of problems, most of them legal in their aspects, which must be well considered by management when the making and marketing of a new product comes up. The questions of local taxes, state taxes, and federal taxes surprisingly enough are often overlooked. The same is unfortunately true where local and state laws affect the manufacturing methods to be used for a new product. There is an abandoned, half-completed $75,000 plant in the Middle West today, a monument to the failure of a chemical manufacturer to inform himself on laws governing industrial waste-disposal methods before he began spending his money. Zoning laws on the responsibility of the manufacturer for property damage must also be very carefully investigated.

There is almost no limit to the usefulness of check sheets of the sort carried as an editorial supplement to *Chem. & Met.* in this issue, but in the final analysis their value depends on the thoroughness with which a manager investigates and answers all phases of the several hundred questions shown. Adequate care and intelligent analysis will result in the elimination of at least a very large percentage of the danger of failure and will result in a much greater opportunity for the quick and profitable marketing of the new product or of the rearrangement and successful marketing of the regular line of the company.

Costs and Statistics

(Continued from page 77)

has such new uses that a huge amount of missionary work will have to be undertaken. Furthermore, it should never be assumed, particularly in the beginning, that a new plant will operate at capacity and that the conventional full-scale operation costs will show the situation for the first year or so. The initial production deficit is often an extremely important factor and may indicate the need to continue the pilot plant until enough tonnage is developed to operate at a reasonable rate. The mistake of lumping too many operations into one cost sheet should be carefully avoided. Separate estimates prepared for individual intermediates in a long complicated process will often show up weak spots that might otherwise be missed.

There is no contention that by the proper use of costs and statistics all mistakes will be avoided, but at least the procedure in introducing a new product can be placed upon a surer foundation.

SULPHURIC ACID RETURNS TO POST WAR AVERAGE

EDITORIAL STAFF

WITH FEW exceptions the trends that had become apparent in sulphuric acid use during 1934 were repeated and strengthened during the year just past. The increase in consumption from 1934 to 1935 was substantially the same as that occurring during the preceding year, the total regaining approximately its average level since 1920. With use still less than three-quarters of the 1929 peak figure, the industry nevertheless had cause for encouragement in that the recovery has been at a steady, sustained rate, as indicated by our chart of production, while the price situation materially improved over that obtaining in 1934. Consumption in 1929 reached the enormous figure of 8,321,000 short tons of acid, on a 50-deg. Bé. basis, with which the latter figures of 5,125,000 tons for 1933, 5,590,000 tons for 1934 and 6,047,000 tons for 1935 must be compared.

Only three of the principal consuming groups showed decreases below 1934, two through changed technical trends and one because of a fortuitous drop in the demand for its products. On the other hand, most of the remaining consuming groups showed marked increases, large enough to raise the year's total by 8.2 per cent. Consumption of acid in the paint and pigment field showed the largest proportional increase, 33.3 per cent, occasioned chiefly by the rapidly expanding market for titanium pigments. As was noted in *Chem. & Met.* during the year (March, 1935, p. 139), one manufacturer of these pigments has installed two recovery plants for producing new acid from the ferrous sulphate waste made in the process. One of the plants did not go into operation until the latter part of the year. The net effect of this recovery made little impression on total acid requirements for the industry.

Recovery in the iron and steel industry was one of the sensations of the year. This activity accounted for the largest tonnage increase in acid consumption, and very nearly the largest percentage, 32.6 per cent. In other metallurgical fields an increase of close to 31 per cent is indicated.

No other consuming group was able to boast increases of such magnitude although several followed at comparatively high rates. The textile industry appears to have consumed some 20 per cent more acid. Owing to economies in acid requirements that have been made in recent years, the rayon and cellulose film industries have been reducing their proportionate needs, but the increase in their output during the year was still sufficient to consume over 17 per cent more acid. Uses in the manufacture of chemicals likewise partook of heavy increases, with additional consumption of over 16 per cent, corresponding to the second largest tonage increase. Miscellaneous users required approximately 14 per cent more and the coal products industry, for ammonium sulphate, 9.35 per cent more, a figure which agrees closely with the increase in all fertilizers for the year.

In our tabulation of acid consumption for the year we have shown a slight drop of 1.8 per cent in acid used in fertilizer manufacture, despite the fact that fertilizer in general increased during the year by 8 to 10 per cent. Preliminary advices from the fertilizer industry indicate that this decrease may have to be revised to an increase of perhaps 3 per cent when year-end figures become available. It appears clear, however, that some lessening in the rate of acid use for superphosphate has taken place. Two explanations are advanced, the one that the over-acidulation of superphosphate is no longer being practiced, the other that with higher grade phosphate rock now being used to an increasing extent not as much acid is required per unit of production.

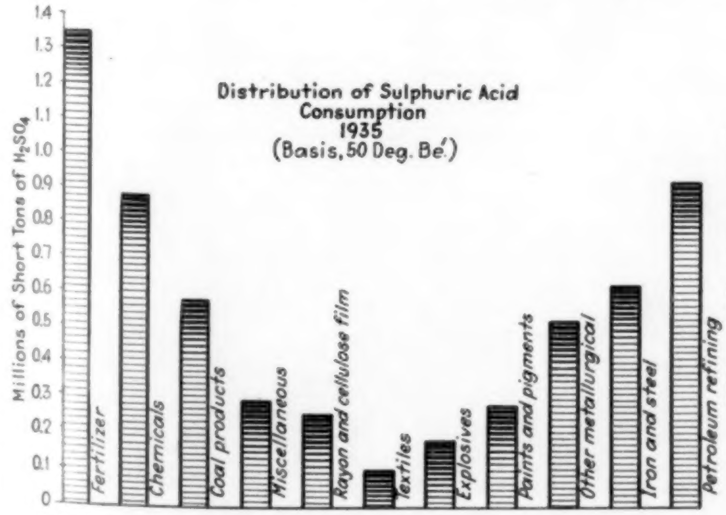
A second decrease occurred in the explosives industry, where a drop in anthracite mining, together with a material lessening of heavy construction, conspired to reduce acid consumption by 2.8 per cent. The third decrease, that in petroleum refining, represents an apparently definite trend toward lower use of sulphuric acid in the preparation of lubricating oils on account of the advent of solvent refining. The exact drop, in the face of increasing petroleum refining, may require later re-evaluation, but the

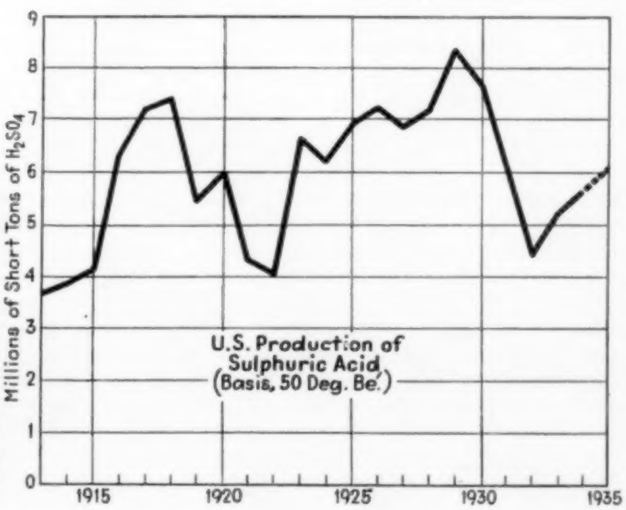
Estimated Distribution of Sulphuric Acid Consumed in the United States

(Basis, 50 deg. Bé.)

Consuming Industries	1933 Short Tons	1934 Short Tons (Revised)	1935 Short Tons
Fertilizer	1,200,000	1,399,000	1,370,000
Petroleum refining	1,140,000	1,100,000	980,000
Chemicals	725,000	765,000	890,000
Coal products	468,000	535,000	585,000
Iron and steel	390,000	475,000	630,000
Other metallurgical	360,000	390,000	510,000
Paints and pigments	170,000	210,000	280,000
Explosives	140,000	180,000	175,000
Rayon and cellulose film	219,000	214,000	252,000
Textiles	90,000	75,000	90,000
Miscellaneous	223,000	250,000	285,000
Totals	5,125,000	5,590,000	6,047,000

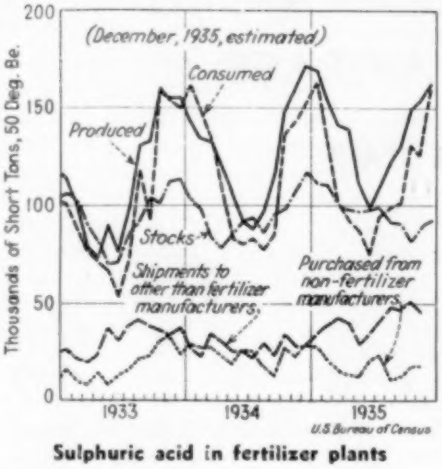
Chem. & Met.'s annual estimates of sulphuric acid consumption and production





11 per cent decline shown in our tabulation is believed to be approximately correct.

Increase in acid production during the year, according to our estimates, was of the same order of magnitude as the increase in consumption, about 7.5 per cent. There appears to have been but little shift in the sources of the 6,085,000 short tons we believe to have been produced, as compared with the earlier year. 1935 estimates of 3,515,000 tons from brimstone, 870,000 tons from domestic pyrites, 950,000 tons from imported pyrites and 750,000 tons from truly byproduct sources compared with the corresponding 1934 estimates of 3,172,000 tons, 864,000 tons, 904,000 tons and 720,000 tons. The last figure, that of the U. S. Bureau of Mines, was split between copper and zinc plants in the ratio of 211,000 tons to 509,000 tons on a 50-deg. Bé. basis. As in 1934, our estimate of contact acid production represents 50 per cent of the total. The proportion has changed but slowly in recent years, having been 43 per cent contact in 1932 and 48 per cent in 1933.



Sulphuric acid in fertilizer plants

Sulphur production figures for the year are not yet available but were probably in the neighborhood of the 1,421,473 long tons of 1934 and the 1,406,063 tons of 1933. Shipments were approximately 1,630,000 long tons, in comparison with the 1,613,838 tons of 1934. The approximate exports of 402,000 tons compare with the 503,312 tons exported in 1934. In the case of pyrites, domestic production for the year is estimated at 420,000 long tons, compared with the actual 1934 production of 432,524 tons. Pyrites imports approximated 380,000 long tons, in comparison with the 1934 figure of 366,315 tons. World figures for sulphur and pyrites are not yet available.

The year was without technical developments in sulphuric acid production. Nor was there any new construction, with the exception of the completion of the ferrous sulphate sulphuric acid recovery unit already referred to above.

NEW RECORDS ATTAINED IN ALKALI INDUSTRY

EDITORIAL STAFF

FROM a statistical standpoint, except in one particular, the alkali industry found itself comfortably situated at the close of 1935. That one particular was a troublesome condition that had for the past several years been developing in the relation between chlorine and caustic soda. With chlorine demand increasing out of proportion to that for its electrolytic partner, caustic soda, the year end found more than one caustic soda sales force wondering how far caustic stocks could climb without precipitating grave difficulties. One large producer, during the year, set to work building a plant to produce chlorine without caustic. Others were understood to be considering such processes.

In the review of the alkali industry published in *Chem. & Met.* in January, 1935, it was stated that an excess of useful and modern soda ash production capacity in the neighborhood of 25 per cent was impending as a result of the construction, during 1934 and 1935, of three large, new plants in the South. As it developed, we were unduly pessimistic at the time, for 1935 saw a marked increase in soda ash production, over 5 per cent more than the previous peak year of 1929, and 11.6 per cent more than 1934. Our present estimate for 1935, subject to later revision, is that 2,580,000 tons was produced, compared with our revised estimate of 2,315,000 tons in 1934. Where total capacity had been about 3,250,000 tons at the end of 1934 the addition 330,000 tons capacity that was added in 1935 (including 14,000 tons of natural soda) brought the 1935 year-end total to 3,580,000 tons. Our estimate of the modern and useful capacity included in this total is in the neighborhood of 3,250,000 tons, so that the production in 1935 was at the rate of 79 per cent of useful capacity. The new construction in the South has resulted in some shifting about of production from North to South to permit taking advantage of water shipment, and one of the southern plants is reported to be operating at a rather small percentage of capacity. But the marked disadvantages that seemed a year ago to be inherent in the southern program have not materialized to the predicted extent. Recovery has established new records for soda ash. The industry has cause for a great deal of satisfaction in the year's results.

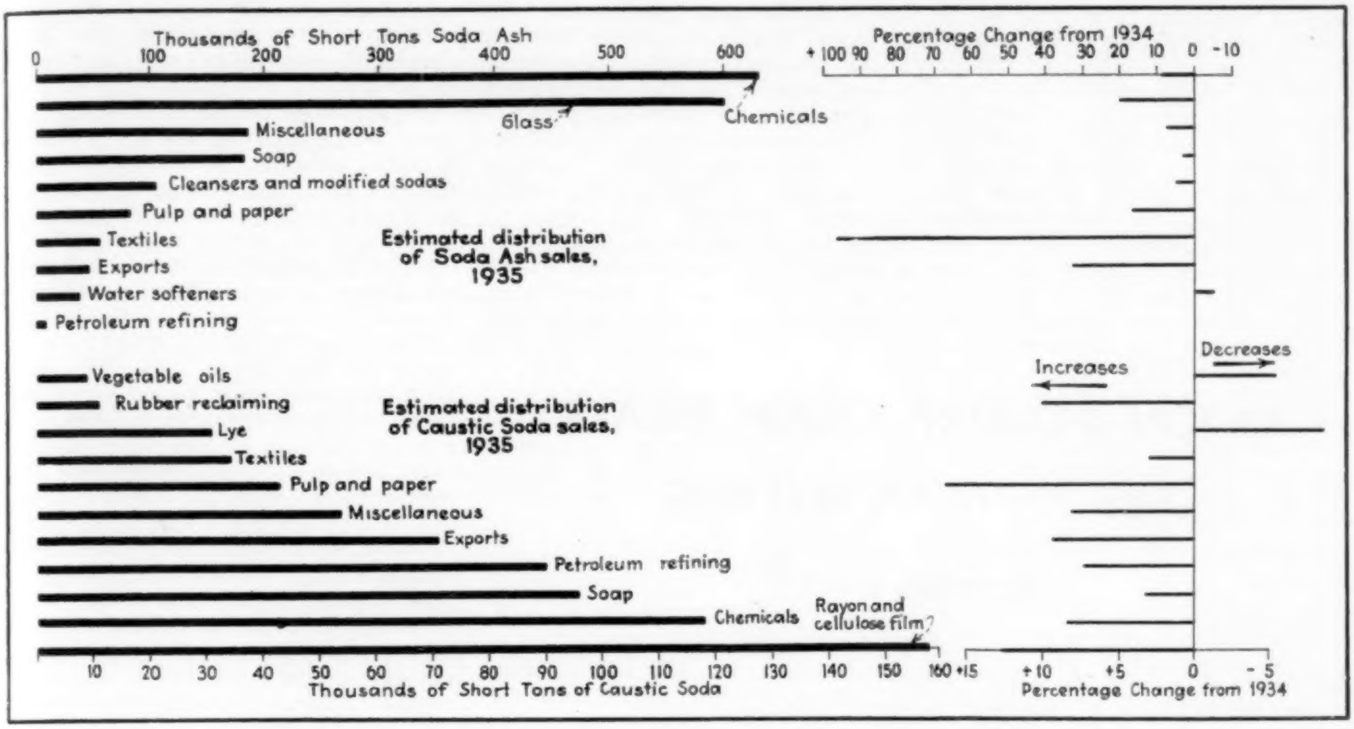
Our annual estimates of soda ash sales to various consumers, in their total, show a trend very similar to that in production. Total sales advanced over 16 per cent beyond 1933, and nearly 13 per cent beyond 1934. In this connection it is interesting to examine the history of soda ash sales during the years of the depression, in comparison with the index numbers of general business activity. The latter, derived from *Business Week's* weekly activity indexes, taking 1929 as 100, are: 1930, 80; 1931, 67; 1932, 50; 1933, 53; 1934, 55; 1935, 58. But for soda ash sales, with 1929 again as 100, the corresponding indexes are: 1930, 91; 1931, 91; 1932, 79; 1933, 100; 1934, 102; and 1935,

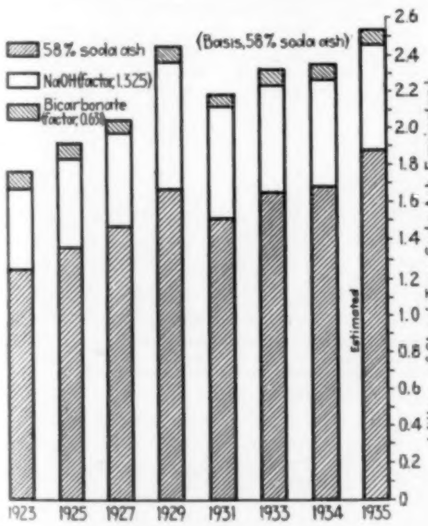
Estimated Distribution of Soda Ash Sales in the United States

Consuming Industries	1933 Short Tons	1934 Short Tons (Revised)	1935 Short Tons
Glass	507,000	500,000	600,000
Soap	170,000	175,000	180,000
Chemicals	510,000	580,000	630,000
Cleansers and modified sodas	94,000	100,000	105,000
Pulp and paper	80,000	70,000	82,000
Water softeners	47,000	40,000	38,000
Petroleum refining	8,000	8,000	8,000
Textiles	34,000	28,000	55,000
Exports	25,000	33,000	44,000
Miscellaneous	179,000	170,000	183,000
Totals	1,654,000	1,704,000	1,925,000

Estimated Distribution of Caustic Soda Sales in the United States

Consuming Industries	1933 Short Tons	1934 Short Tons (Revised)	1935 Short Tons
Soap	86,000	93,000	96,000
Chemicals	100,000	109,000	118,000
Petroleum refining	87,000	84,000	90,000
Rayon and cellulose film	144,000	140,000	158,000
Lye	31,000	34,000	31,000
Textiles	38,000	33,000	34,000
Rubber reclaiming	9,000	10,000	11,000
Vegetable oils	9,000	9,500	9,000
Pulp and paper	40,000	37,000	43,000
Exports	60,000	65,000	71,000
Miscellaneous	41,000	50,000	55,000
Totals	645,000	664,500	716,000





U. S. production for sale of principal ammonia-soda products

Production of Caustic Soda in the United States

(Short Tons)

Year*	Lime-Soda	Electrolytic	Total
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	387,235	186,182	573,417
1929	524,985	236,807	761,792
1931	455,832	203,057	658,887
1933	439,363	247,620	686,983
1934 (revised)	438,000	265,000	703,000
1935 (estimated)	440,000	315,000	755,000

*Figures for 1921-1933 are from the U. S. Bureau of the Census. Electrolytic caustic soda figures do not include that made and consumed at wood-pulp mills, estimated at about 30,000 tons in 1927 and 1929, at about 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934 and 17,000 tons in 1935.

116. Few heavy industries can claim such a record, even other branches of the chemical field where the depression was undoubtedly less severe than in most spheres of industrial activity.

If in total sales of soda ash the trend was an extrapolation of the records of earlier years, in individual cases no such regularity was marked. The textile industry took individual honors for the largest percentage increase, with a rise of 97 per cent, or perhaps even more, in the purchase of ash. This record follows from the great increase which the wool industry enjoyed during the year. Exports, based on 11 months' figures, rose about 33 per cent, and glass, 20 per cent. With little change in containers and only a moderate increase in ash consumption for flat glass, the advance in plate for automobiles occasioned both by the increasing use of safety glass, and by the marked rise in the number of automotive units produced, brought the ash tonnage increase in the glass industry far above the increase in any other field of use.

The pulp and paper industry increased its ash consumption by about 17 per cent during the year while chemicals showed a greater tonnage increase, although smaller percentagewise, of 8.7 per cent. Miscellaneous uses increased by nearly 8 per cent and the purchases for cleansers and modified sodas, by 5 per cent. Soap, which changes but little with business conditions, reflected the rise with an increase of 2.9 per cent, while petroleum refining, despite its increase, showed little or no change in soda consumption. Only in the field of water softeners was a decline registered, and this a small one, not over about 5 per cent.

The same optimistic picture we have noted for soda ash cannot be painted for caustic soda, as was noted in an earlier paragraph. There was no inherent weakness in the consumption of this chemical. Rather, an actual and considerable overproduction was forced by increasing chlorine demand. Were it not for the lime-soda production of caustic, of course, this situation could not have arisen. But the lime-soda industry has gone about its even affairs, producing caustic at a substantially constant rate for the last several years, while electrolytic producers, to meet the rising chlorine demand, have of necessity increased caustic production each year since the industry's low point in 1932. A comparison of our tabulation of caustic production with the total of caustic sales for the last three years will show the small but continuing discrepancy between production and sales that today is responsible for many of the industry's headaches. It is to be hoped that the new methods for independent chlorine production will speedily set this situation to rights.

Caustic soda production, in its total, increased in the neighborhood of 7.5 per cent, from the 703,000 tons of 1934 to 755,000 tons in 1935. Very little of the increase, less than 0.5 per cent is chargeable to the lime-soda process, whereas, on account of the chlorine situation, electrolytic producers raised production by nearly 19 per cent. The increase in sales, 7.8 per cent, was obviously insufficient to take up the slack.

A 16.2 per cent rise in pulp and paper

usage of caustic seems to have led the list of increases. Owing to the remarkable increase in rayon and cellulose film production, considerably more than sufficient to offset the greater efficiency with which these industries are now using caustic, the increased consumption here was nearly 13 per cent. An increase in rubber reclaiming advanced its caustic consumption by 10 per cent while exports rose by 9.3 per cent. Use for chemicals advanced 8.3 per cent, and for miscellaneous purposes, 8 per cent. A 7.2 per cent increase was shown in petroleum refining, and one of 3.2 per cent in soap. Textiles in general enjoyed no such improvement as wool, with the result that only a 3 per cent increase can be recorded for caustic soda in this industry. Vegetable oils changed but little, possibly declining about 5 per cent. The largest decrease, 8.8 per cent in lye consumption, is credited to the government's slaughtering program which materially decreased farm purchases of lye for soap.

RAYON INDUSTRY AGAIN BREAKS ALL PREVIOUS RECORDS

EDITORIAL STAFF

As *Textile World* remarked editorially last September in forecasting substantial new records for both world and United States rayon production, "this is getting to be monotonous." Yet the seemingly overoptimistic prediction made at that time appears to have been several per cent too low in the light of the final figures compiled and recently published by *Rayon Organon*. This monthly bulletin, to which the industry supplies its production and shipment figures for lumping to conceal data of individual concerns, has announced that 1935 in the United States rayon industry saw the production of 256,659,000 lb. of rayons of all sorts, an increase of 23 per cent over the 208,496,000 lb. of 1934. The record is an advance of nearly 20 per cent above the previous peak year of 1933. It will be recalled that the final production of nitrocellulose rayon in this country occurred in 1934. With the disappearance of this factor from the rayon scene, we estimate that 1935 production was divided substantially as follows: 192,800,000 lb. of viscose rayon, 8,000,000 lb. of cuprammonium and 55,859,000 lb. of acetate. The last, it should be noted, is the official acetate figure as reported in the *Organon*.

One interesting feature of this breakdown is the manner in which it has been changing. Prior to 1919 viscose was the only rayon produced commercially in this country. Manufacture of acetate commenced in a small way in that year but offered no real competition to viscose for a number of years. In fact, it was not until 1925 that acetate gave any evidence of the prominence it was later to assume. And not until 1931, when interest in its production became general, did it advance to a considerable proportion of the total. Today acetate may well be considered the sensation of the industry. In 1935 it accounted for nearly 22 per cent of the total, about four times the tonnage of 1931. And viscose, still the heavy tonnage variety, has fallen from 85 per cent in 1931, to 75 per cent in 1935.

The history of the two minor rayons is less significant. The year 1920 saw the introduction of nitrocellulose rayon manufacture into the United States and this type shortly reached an importance where it annually accounted for about 10 per cent of the total. This peak was passed in 1927, however, and nitro entered a decline which culminated in its demise in 1934. Cuprammonium rayon, the fourth variety, was first produced late in 1926, attaining commercial importance in 1928. By 1932 it had reached 4.5 per cent of the total, but despite slowly rising output, the percentage has since declined until today it stands at an estimated 3.1 per cent.

Not only in the United States did rayon break its previous records for *Textile World's* estimate, with which the *Organon* is in approximate agreement, indicates a world increase of 20 per cent for the year, to a total of about 960,000,000 lb. The significant feature here is not so much the total, as its source, which has shifted in recent years to make Japan a close competitor of the American industry for first honors. In 1935 the United States accounted for 26.8 per cent; Japan, 21.9 per cent; and Italy, Germany and Great Britain, as poor thirds, about 12 per cent each. In 1934 the corresponding percentages were: 26, 18.8, 13.3, 11.4 and 11.1. And yet, according to the *Organon*, Japan is practicing production control, with a considerable part of its rayon capacity officially shut down!

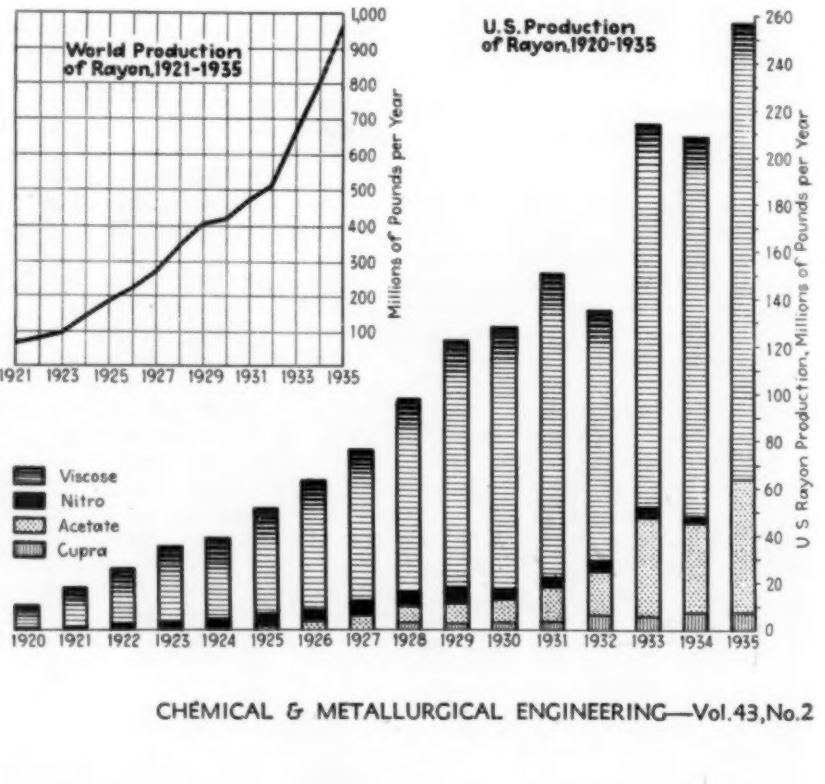
Few developments of striking technical importance occurred during the year, although certain earlier trends were accentuated. Rayon colored by the addition

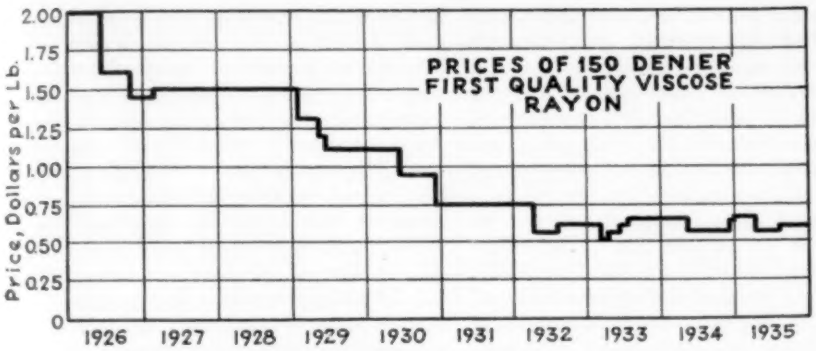
Rayon Production and Imports, 1921-1935

	Thousands of Pounds		
	U. S.* Production	U. S.† Imports	World* Production
1921	18,000	3,276	65,000
1922	26,000	2,116	80,000
1923	35,000	3,029	97,000
1924	38,750	1,954	141,000
1925	52,200	5,441	185,000
1926	62,575	9,345	219,000
1927	75,050	15,028	267,000
1928	97,700	12,117	345,000
1929	121,399†	15,039	404,000
1930	127,333†	6,341	417,000
1931	150,879†	1,804	470,000
1932	134,670†	197	509,000
1933	213,498†	934	660,000
1934	208,496†	77	799,589
1935	256,659†	(est.) 22	959,580

*From *Textile World* except as noted.
†From *Rayon Organon*. Imports to 1930 cover yarns, threads and filaments; since 1930 yarns, single and plied.

Rayon's progress in post-war period





Rayon prices are near their probable minimum for present processes

of dye to the spinning solution demonstrated its commercial acceptability. Staple fibers took on added importance. Considerable plant capacity was added and a new source of wood pulp suitable for rayon became imminent with the successful use of southern pine pulp in experimental rayon manufacture. (See *Chem. & Met.*, Sept., 1935, p. 486.) Work at Boyce Thompson Institute shed new light on the structure of cellulose, upsetting the old micelle theory and showing cellulose to consist of minute cellulose particles cemented together with a non-cellulose pectic material. Rohn & Haas has developed a new cellulose solvent said to accomplish true solution rather than the colloidal dispersion of earlier "solvents." What effect the new discoveries may have on the rayon industry only the future can demonstrate.

Use of cellulose films for wrapping purposes became even more firmly entrenched during 1935. For a great many purposes the practice no longer involves novelty and must now depend for its acceptance on intrinsic worth, rather than its attention-getting value. That the worth actually exists seems definite, for production continued its increase, reaching for both the viscose and the acetate films an estimated total of between 55 and 60 million pounds, between 10 and 20 per cent increase over the preceding year.

IMPROVED MARKETING PRACTICES BENEFIT FERTILIZERS

By R. S. McBride
EDITORIAL REPRESENTATIVE, CHEM. & MET.
WASHINGTON D. C.

FERTILIZER production in 1935 was approximately 6,200,000 tons. Thus, the output was almost equal to that of 1931, although only 72 per cent of the all-time peak of 1929. Production in 1936 is expected to be 8 or 10 per cent above last year even though some substitute for AAA is established. Should agricultural production go wholly unrestrained by new Federal regulation, an even greater increase in fertilizer usage may follow. But no well based estimate of the increase to be expected exceeds 15 per cent of 1935.

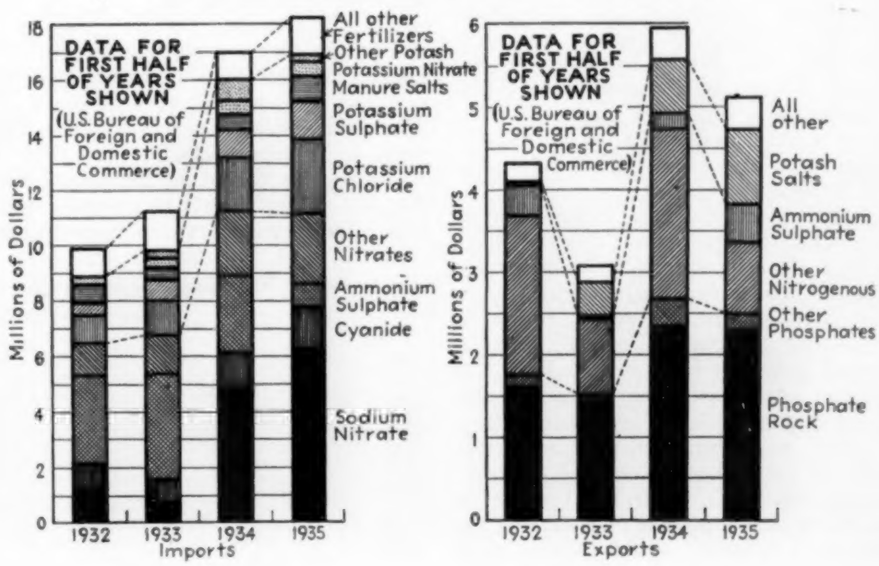
The fertilizer industry had, in 1935, a profitable year, largely the result of improved marketing practices which were continued under the vigorous influence of the industry's leaders despite the discontinuance of the NRA code. The educational work done during Blue Eagle days was sufficient to convince a majority of the industry that self-restraint was profitable. And self-restraint was quite evident during the past year, which saw but little of the former cut-throat competition, ruthless price cutting, and post-season price adjustment so common recently.

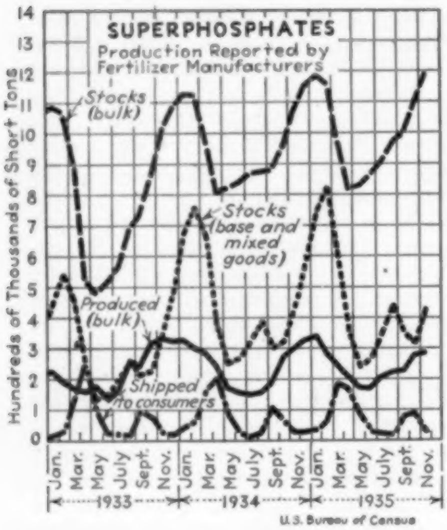
The number of grades of fertilizer marketed last year was materially less than in preceding years. This simplification trend and the continuance toward higher analysis goods were both probably small but significant factors in the improved business conditions. Further small economies come from legislative changes made in certain states. Thus, 1936 begins with all states but South Carolina and Georgia recognizing the standard basis for quoting fertilizer composition. The former state varies both from the standard arrangement, N-P-K, and in stating grades in terms of NH_3. Georgia permits the preferred nomenclature required in most states, but uses the order, P-N-K.

Probably the outstanding technologic event in the fertilizer industry last year was the large scale experimental development by the Tennessee Valley Authority of high concentration superphosphate from electric-furnace phosphoric acid. In two articles appearing in *Chem. & Met.* in 1935 (June, p. 320 and Sept., p. 488) Curtis has described most of the technique of manufacture. An analysis of the costs involved is now being made and it is anticipated that later this year these data of large economic significance will be available. Thus far, however, there has been no indication that the new furnace methods are sufficiently cheaper to imply early supplanting of the common sulphuric acid procedure for making superphosphate.

Production of fertilizer by TVA has been on a substantial scale, but this

U. S. fertilizer materials imports and exports, 1932-35





Superphosphates, 1933-35 (Based on reports representing about 95 per cent U. S. total)

Government agency has not sold any of its output. The material has been used for demonstration farms, for research in cooperation with state and farm-cooperative groups, and to some extent for soil-erosion control projects of the Government. The quantities produced have been so large, however, that a few in the industry feel that commercial sales are actually somewhat affected. It becomes an important question, therefore, whether the activities of TVA may not approach competition with the industry, even though the present policy is continued of using, not selling, its output.

Other significant technical developments of the past year included production of crystalline urea by du Pont; the beginning of manufacture on a large scale of 32 per cent granular superphosphate by American Cyanamid; and the commercial trial on a semi-works scale of the method for making phosphate "available" by treating rock with steam in the presence of silica. This last process, rediscovered by Jacob of the U. S. Bureau of Chemistry and Soils, apparently offers some opportunity for economical manufacture of phosphate-base material without use of either acid or furnace processes.

Although the U. S. Department of Agriculture has stated that fertilizer prices should continue to trend downward, there is no apparent justification for that forecast. It seems rather to represent a hope of officials than a sound judgment from cost studies. The decline in the cost of agricultural chemicals during the last 2 years has already showed its influence on fertilizer prices of last year. The uptrend of chemical prices which is occurring because of many economic influences, including the threat of inflation, would seem to make a slight rise in fertilizer cost and consequent rise in fertilizer prices much more likely than any decline.

Stability of fertilizer prices will undoubtedly be largely aided by the expected decision of the Federal Trade Commission, which may be rendered even before this material reaches readers of *Chem. & Met.* The desire of the industry, in its request for a voluntary code of trade practices containing provision for open-price filing, probably has caused the delay in final adoption and promulgation of these rules. The best guess at the time this material is written is that a modified plan for filing of prices will be authorized by FTC.

Two outstanding corporation developments of the year also may tend toward stabilization of the industry's activity. Davison Chemical Co. completed its reorganization and is now operating without court supervision or receivership. This company has been further strengthened by the absorption during the year of the Ober interests. Virginia-Carolina Chemical Co. also has completed its reorganization and is now under the leadership of those who controlled its destinies until the intervention of broker-led preferred-stock holders gave the latter temporary dominance. A rebuilding of the sales organization is planned, so that this company is likely again to become one of the most aggressive of the Big Seven of the industry.

POTASH PRODUCTION INCREASED SHARPLY DURING 1935

By J. W. Turrentine
PRESIDENT, AMERICAN POTASH INSTITUTE, INC. WASHINGTON, D. C.

AS A WHOLE the world potash industry participated in the general industrial and economic recovery which characterized the year 1935. This industry whose major activity pertains to providing an agricultural necessity, found reflected in its own improved status the results of agricultural betterment, realized in the principal agricultural, and therefore potash-using, countries of the world.

During the calendar year 1935 potash produced and sold by the domestic industry approximated 395,000 short tons of salts, equivalent to 213,000 tons K_2O. These sales, when compared with those of 1934, amounting to 220,690 tons of salts, equivalent to 113,250 tons K_2O, show an increase of 175,700 tons of salts and of about 100,000 tons K_2O (88 per cent). This output for the most part was in the form of high-grade muriate (potassium chloride) approximating 60 per cent K_2O, with smaller tonnages of lower grade salts known in the fertilizer trade as "manure salts."

During this period, as heretofore for the past several years, three major and two minor producers reported output constituting the bulk of the production here recorded. These were the American Potash & Chemical Co., operating at Searles Lake, Calif., the United States Potash Co. and the Potash Co. of America operating mines near Carlsbad, N. M., the United States Industrial Chemical Co. producing byproduct potash from distillery waste, and the Hagerstown Portland Cement Co. producing byproduct potash from cement dust. In the table below recent domestic production is shown.

Exports of potash salts during the first 11 months of the year amounted to 72,576 tons, valued at $1,855,800, a striking advance from the exports of the corresponding period of the preceding year amounting to 25,088 tons, valued at $829,800. Materials shipped abroad were for the most part in the form of high-grade potassium chloride, on which basis the K_2O equivalent of exports approximated 43,000 tons.

Imports of potash salts designed principally for fertilizer use during the year under review (first eleven months) amounted to 519,370 short tons equivalent to 211,335 tons K_2O and valued at

Potash Produced and Sold in the United States

(In short tons; source, The Mineral Industry)

Year	Production: Potash Salts	Production: Equivalent	Sales: Potash Salts	Sales: Equivalent	Sales: Value F.o.b. Plant
1925	51,565	25,448	52,823	25,802	1,204,024
1926	46,324	23,366	51,369	25,060	1,083,064
1927	76,819	43,150	94,722	49,500	2,448,146
1928	104,129	59,910	105,208	60,370	3,029,422
1929	107,800	61,590	101,370	57,540	2,988,450
1930	105,810	61,270	98,280	56,610	2,986,160
1931	133,920	63,880	133,430	63,770	3,086,955
1932	143,120	61,990	121,390	55,620	2,102,590
1933	351,250	148,150	324,417	138,770	5,225,646
1934	429,300	150,700	220,690	113,250	2,825,650

$8,972,850. These values are to be compared with the corresponding figures of 1934 when imports totaled 414,272 tons of potash salts, equivalent to 150,596 tons K_2O and were valued at $8,104,416.

As recorded by the U. S. Bureau of Foreign and Domestic Commerce these imports for 1935 were made up of 231,361 tons of muriate (50 per cent K_2O), 86,965 tons of manure salts (30 per cent K_2O), 81,936 tons of sulphate of potash (48 per cent K_2O), 76,620 tons of kainite (20 per cent K_2O) and 42,217 tons of nitrate of potash (35 per cent K_2O). Countries of origin as heretofore were principally Germany, France and Spain, with some imports of potassium nitrate from Chile.

In addition to the foregoing, 18,581 tons of potassium compounds in the category of industrial chemicals, valued at $2,106,496, were also imported during this period. The principal items were the carbonate, 1,902 tons, the chlorate and perchlorate, 6,181 tons, the hydroxide, 1,642 tons, and argols, tartar and wine lees, 7,667 tons. The corresponding totals for 1934 were 21,375 tons, valued at $2,626,890.

In the absence of reliable figures pertaining to potash stocks held by producers, importers and consumers, it is impossible to state with full accuracy what the tonnage of potash actually consumed in American agricultural and chemical industries amounted to during the year under review. The closest approach to this figure is approximated by adding domestic sales to imports and subtracting exports. The statistical data at present available are too incomplete to attempt to arrive at a definite figure but are sufficient to make it apparent that consumption showed a marked increase during this period.

During the year under review the price of muriate of potash—the potash salt sold in largest quantities on the American market—quoted on the unit basis (1 per cent of a ton or 20 pounds K_2O) was 45 cents, subject to seasonal discounts, an advance from 40 cents, less seasonal discounts, quoted during 1934. For their true significance these prices must be compared with those, averaging about 65 cents per unit, which were formerly in effect.

Technical Advances

The outstanding development in the domestic industry during 1935 was the construction of the new refinery of the Potash Co. of America at Carlsbad, N. M. This refinery employs a unique process developed by this company based upon flotation principles of separating sodium chloride from potassium chloride, the two salts composing the natural mineral, sylvinite. It is recalled that the method in common use heretofore depends on the fractional dissolution of sylvinite in a hot brine saturated with the less soluble of the two, sodium chloride, which dissolves only the potassium chloride. The resulting solution, now saturated with both, is then cooled to precipitate the potassium chloride, separation thus being effected by the widely varying temperature coefficient of solubility of the respective salts. The new flotation method yields muriate of high purity as established by the preliminary commercial operation of the plant. As a result of the success of this new development it is anticipated that this refinery will have a production capacity of some 80,000 tons of KCl.

With the addition of the aforementioned new tonnage of high-grade muriate, American production would be increased to 400,000 tons of muriate of marketable grades.

Also among the new developments of the year was the organization of the American Potash Institute, Inc., with headquarters in Washington, D. C., and branch offices in Atlanta, Ga., San Jose, Calif., Lafayette, Ind., and Hamilton, Ont. The new organization is a consolidation and expansion of the Agricultural and Scientific Bureau formerly maintained with signal success for years past by the potash importers. The purpose of the Institute is to lend its aid to agricultural research in its bearing particularly on the role of potash, together with phosphates and nitrogen, in crop production, as likewise to disseminate scientific information bearing thereon, a move on the part of the potash industries in recognition of the importance of scientific data as the basis of industrial progress. There is the further conviction widely held that the profitable use of potash in American agriculture is far below its logical level, vast areas in cultivation being so depleted in this essential plant food that crops grown thereon exhibit abundant symptoms of potash starvation.

The event of outstanding interest as related to the European potash industries and the international potash trade was the announcement of the alliance of the Spanish producers with the European potash cartel already comprising the German, French and Polish producers. It is recalled that of the three Spanish potash mines in active operation, one was already allied with the cartel. With the alliance of the other two, there was terminated that aspect of competition which had brought about price reductions below the point where continuity of operation was possible. With the removal of this disintegrating situation, stabilization resulted with prices still far below those at which potash had been offered previously.

The expansion of the potash industry in the Soviet Republics continued with further developments in plant and output, as likewise, but more moderately, at the Dead Sea plant in Palestine. The older and more firmly established industries of Europe, notably the German and French, maintained their progressive recovery from the former state of reduced operations occasioned by the recent world-wide state of agricultural distress.

In the industrial field, consideration is warranted of the possibility of new or extended potash use as a result of its present low cost. To what extent has its use in the past been restricted in this field by price? Does the present reduced price justify a review of existing markets for the more specialized potash chemicals to weigh the possible effects of passing on to the consumer the advantage represented by the present lowered cost of the basic raw materials? The time which has elapsed since the inauguration of these low prices is too brief to find the effect reflected in results, although it seems safe to conclude that these possibilities are being scrutinized by the industrial chemist.

Potash Materials Exported From the United States*

(In long tons, potash salts)

Year	Fertilizer Salts Tons	Fertilizer Salts Value	Chemical Salts Tons	Chemical Salts Value	Total Tons	Total Value
1929	13,868	$582,690	1,311	$583,668	15,180	$1,166,358
1930	15,216	643,367	1,121	498,774	16,337	1,142,141
1931	28,982	1,267,120	1,030	370,935	30,012	1,638,055
1932	1,816	70,028	791	241,179	2.607	311,207
1933	25,117	910,406	1,138	301,596	26,255	1,212,002
1934	25,540	918,205	2,120	466,893	27,660	1,385,098
1935 (11 mos.)	64,797	1,855,780	3,475	600,746	68,272	2,456,526

*Monthly Summary, U. S. Bur. Foreign & Domestic Commerce.

Potash Fertilizer Salts Entered for Consumption in United States

(In long tons; source, The Mineral Industry)

Year	Kainite	Manure Salts	Muriate	Sulphate	Nitrate	Total
1925	182,828	384,232	161,028	68,952	......	797,040
1926	181,877	316,440	199,151	69,873	9,416	767,341
1927	102,987	277,998	163,817	68,904	8,072	613,706
1928	107,051	404,680	233,611	86,458	14,411	831,800
1929	75,930	390,828	230,966	79,510	20,868	777,909
1930	112,176	361,688	273,211	86,257	14,107	833,879
1931	55,329	179,428	180,539	56,842	18,240	472,138
1932	49,374	100,927	78,358	28,071	17,927	257,730
1933	102,000	113,121	105,538	45,535	26,429	366,194
1934	114,000	79,280	127,000	62,000	31,614	413,900
1935 (11 mos.)	68,411	77,647	206,572	73,157	37,694	463,723

PLASTICS MAKE NEW HIGH RECORDS

EDITORIAL STAFF

THE PRODUCTION of cellulose acetate plastics increased from 200,000 lb. in 1931 to 11,000,000 last year. Such a growth makes one wonder just what the ceiling will be and when it will be reached. Also, it is estimated that 55,859,000 lb. of acetate yarn, and between 2,000,000 and 2,800,000 lb. of safety film were produced during 1935. Last year 45,000,000 sq.ft. of safety glass was made for the automobile industry. Cellulose acetate was used in 85 per cent of this glass.

There has been about 100 per cent increase in the cellulose acetate plastics during the past year. Injection molding has gained in popularity as it means lower cost production for some types of articles. Each new year finds more and more cars equipped with cellulose acetate hardware. Two makes of cars are equipped with acetate steering wheels and others will follow soon. Shortly wheels will probably be made by covering metallic cores with acetate by extrusion.

The price of cellulose acetate has shown a decrease during the year due to increased volume of production, improved methods of manufacture, and recovery of glacial acetic acid and the anhydride. The current contract price is under 50c. per lb.

Cellulose Esters

Much has been heard of other cellulose esters and mixed cellulose esters. Ethyl cellulose is being produced on a small scale at present by the Hercules Powder Co. A larger plant will be completed in the spring. Even at the high price of $1.50 a lb. considerable interest has been shown in special flexible lacquers and in admixtures to toughen oils, resins, and waxes. In general, uses indicated for ethyl cellulose depend on its unique properties of toughness, flexibility at low temperatures, miscibility with many materials, solubility in cheap solvents, chemical inertness, and splendid aging properties even under light. It is an excellent plastic, as it requires only small quantities of common plasticizers. It molds excellently. So far, however, the price has kept it out of widespread application. Advance Solvents and Chemical Corp. is importing ethyl and benzyl cellulose, each in three degrees of viscosity. Their sales of these materials have been largely for the purpose of lacquer manufacture.

Nitrocellulose has lost some of its market to cellulose acetate and other plastics. However, the past year witnessed an important increase in the quantity produced and sold. Production of sheets, rods and tubes in 1934 totalled 12,360,000 lb. (omitting quantity consumed in company plants), which compares with 16,205,000 lb. last year. Of this quantity, 12,528,000 lb. was in the form of sheets, 2,739,000 lb. was in the form of rods, and 938,000 lb. was in the form of tubes. The 1929 output of nitrocellulose was 25,000,000 lb.

Phenolic Resins

A new record was attained by the phenolic resins in 1935, when 56,000,000 lb. of products—molding materials, laminating, varnish, cast and miscellaneous materials—were made. Filled and unfilled molding material amounted to 35,000,000 lb., laminated 10,000,000 lb., varnish resins 2,000,000 lb., cast resins 4,750,000 lb., and miscellaneous other resin and varnish materials 4,000,000 lb. About 8,000,000 lb. of modified phenolic resins such as Albertol, which is used in paints and varnishes, were made. The glycerol phthalate type of resin made for coatings amounted to 12,000,000 lb.

Phenolic resinoids made an important gain for denture material and for lining beer cans. Black and brown resins sold at a minimum of 12c. per lb. and averaged about 14c.

The cast type of phenolic resin also had a successful year, it is estimated 4,750,000 lb. were produced. From 35 to 40 per cent were used for buttons, handles and the like; 20 per cent for novelties; 7 per cent for architectural purposes (wall board, bar fixtures, fronts, columns, lighting fixtures, display fixtures and signs). Among the miscellaneous applications is cement for laminating wood products. The solid colors sold at 46c. per lb. and the water white at 55c.

The patent situation was settled during the year, the Catalin Corp. of America winning a decision over the Catalazuli Manufacturing Co. In addition to Catalazuli, Nixon Nitration and Celluloid discontinued production of cast phenolic resin during the year. Only Catalin, du Pont, Bakelite, Fiberloid, Joanite and Marblette remain as producers.

Last year, when discussing urea resins it was stated that few important changes had occurred in the industry. The same statement might be repeated at this time. The patent situation was not settled although it has probably approached the point where a settlement will be made before our next report is written. While the Bakelite Corp. became a licensee two years ago of one the producers it has not as yet commenced production of these resins.

Production of urea resins increased from 5,000,000 lb. in 1934 to 6,200,000 lb. last year. During the past year the E. I. du Pont de Nemours & Co. began production of crystal urea at Belle, W. Va., so that the resin industry is now assured of a domestic supply. The price of the urea resins declined somewhat due principally to larger quantity discounts. The base price is 35c. per lb. for granulated in 200 lb. lots.

Perhaps the most noteworthy new application for the resin is a cover for a large scale. The molding weighs over 9 lb. This molding indicates that large objects may be satisfactorily molded. Considerable interest has been displayed in use of urea molding materials for illuminating purposes and it is thought that this will prove to be one of the permanently important fields for this material.

Vinylite of Carbide & Carbon Chemicals Corp. has built up a splendid reputation. Manufacturing facilities are said to have been limited to less than 1,000,000 lb., but a new plant with a capacity of 4,000,000 lb., located at South Charleston, W. Va., will commence operations April 1. The price for the base resin has been reduced during the year from 80 to 65c. per lb.

The principal applications for this resin are: linings for beer cans; sun visors for automobiles; adhesive; denture; floor tile; varnish; tooth brush handles; coated paper for liners used in screw caps for foods, pharmaceuticals, etc.; and coated paper for wrapping dried fruit.

Soya Bean Resins

During the past year plastics made with soya bean came in for considerable attention. The Ford company has been making considerable quantities of buttons for horns, gear shift level balls, light switches and ignition distributor covers from the resin. In addition, it is said that window frames for cars are now being molded from the resin. The same company is starting production of these and other molded parts for the automobile in a much larger plant recently completed.

OUTPUT OF NITROGEN PRODUCTS NEAR PRE-DEPRESSION PEAKS

NITROGEN products were manufactured during 1935 at a rate almost equal to pre-depression peaks. The combination of world output in byproduct, synthetic, and natural-nitrate compounds held slightly more than 2,200,000 short tons of contained nitrogen. This is about 8 per cent below the quantity of nitrogen contained in the greatest world production of the peak years, 1929 and 1930.

Renewed agricultural activity throughout the world stimulated most of this business. Intensive military preparation and war activities of Italy were a negligible factor. Even the preparedness campaigns of other nations did not materially affect actual manufacture to any large degree, and then only late in the year.

The consumption of nitrogen during the last fertilizer year, ending June 30, 1935, is the largest on record, topping the previous peak of 1929-30 by about 4 per cent. Consumption of industrial chemical and other non-agricultural nitrogen was at the peaks for post-War years; both this and agricultural uses increased approximately 8 per cent over the preceding fertilizer year.

The production of natural Chilean nitrate was much higher than during the preceding two seasons. But the output, a trifle under 200,000 tons of contained nitrogen, was only about 40 per cent of the last pre-depression year, and a still smaller percentage of the peak output of the earlier period before synthetic processes so largely supplanted natural nitrate. Nevertheless, the enlarged activity in Chile has contributed significantly to the well-being of that nation, and somewhat stabilized its trade.

In the aggregate, synthetic processes provided for 75 per cent of all nitrogen compounds made; 17 per cent of the output was from byproduct sources and 8 per cent from Chile. Most marked increase of synthetic production last year was in Russia, Germany, and Japan. It is estimated that on the average synthetic nitrogen plants of the world operated at only 43 per cent of rated capacity during the last fertilizer year. These plants, including those making cyanamide, are estimated to be capable of fixing 3.85 million short tons of nitrogen per year. (These data, and those of the accompanying table, are from the last annual report of the British Sulphate of Ammonia Federation.)

During the past year the world agreement regarding nitrogen markets was extended by the European Nitrogen Cartel. Subsequently satisfactory terms were negotiated also with Chilean producers. Hence it is not anticipated that cutthroat marketing will be renewed, or that production or prices will soon again get far out of step. British authorities also report satisfactory arrangements with Japanese producers, thus largely stabilizing the Oriental situation also. The American market, of course, remains a favorite competitive playground.

In the United States the major trends of production and consumption during 1935 continued along lines indicated by the preceding year's activity. Several new products were developed and the total output in both byproduct and synthetic divisions of the industry increased, by approximately 10 per cent. The total nitrogen consumption rose slightly more than this, so that stocks on hand at the end of the year were in the aggregate, a trifle lower than at the beginning of 1935.

Ammoniation of fertilizers became an even more important factor in nitrogen consumption than previously. For this purpose various combinations of ammonia were used, including a newly developed ammonium nitrate solution, marketed by The Barrett Company as "B2 Solution." During the year crystal urea was offered for the first time, by duPont. An Allied's Atmospheric Nitrogen Division started work on its new nitrate of soda process in which salt is the raw material and chlorine one of the co-products.

Imports of nitrogenous materials declined slightly in the aggregate, despite a 20 per cent increase in the import of sodium nitrate. Exports rose by 10 per cent over the preceding year. It happened that the import and export of ammonium sulphate just about balanced; but the total supply of this type of fertilizer nitrogen increased, because of the larger output at byproduct coke works, which amounted to approximately 10 per cent over the preceding year.

World Production and Consumption of Pure Nitrogen for the Fertilizer Years
(In metric tons)

The following figures are taken from the fifteenth annual report of the British Sulphate of Ammonia Federation, Ltd. They are offered as fair estimates but strict accuracy is not claimed for them.

Product	1928/29	1929/30	1930/31	1931/32	1932/33	1933/34	1934/35
Production:							
Sulphate of Ammonia:							
Byproduct	376,000	424,440	359,594	301,655	257,719	307,050	315,905
Synthetic	485,000	442,100	349,087	522,207	559,984	534,743	519,829
	861,000	866,540	708,681	823,862	817,703	841,793	835,734
Cyanamide	192,000	263,800	200,932	134,604	168,495	195,245	238,448
Nitrate of Lime	136,000	130,500	110,585	78,939	118,241	107,192	153,113
Other forms of Nitrogen*							
Synthetic	383,000	427,300	393,150	347,842	462,060	515,477	591,242
Byproduct	51,000	51,400	30,940	29,970	39,560	48,259	44,429
Chile Nitrate	490,000	464,000	250,000	170,000	70,800	84,300	178,400
Total production	2,113,000	2,203,540	1,694,288	1,585,217	1,676,859	1,792,266	2,041,366
Percentage Increase, or Decrease	+22.6%	+4.3%	—23.1%	—6.4%	+5.8%	+6.9%	+13.9%
Consumption:							
Manufactured Nitrogen	1,452,630	1,586,904	1,377,005	1,417,126	1,619,705	1,714,040	1,836,506
Chile Nitrate	419,450	363,893	244,300	138,208	127,242	163,550	194,355
Total consumption	1,872,080	1,950,797	1,621,305	1,555,334	1,746,947	1,877,590	2,030,861
Percentage Increase, or Decrease	+14.0%	+4.2%	—16.9%	—4.1%	+12.3%	+7.5%	+8.2%
Agricultural consumption about	1,670,000	1,750,000	1,455,000	1,412,000	1,586,000	1,673,000	1,792,000
Percentage Increase, or Decrease	+14.4%	+4.8%	—16.9%	—3.0%	+12.3%	+5.5%	+7.1%

*Including nitrogen products used for industrial purposes (except Chile nitrate) and ammonia in mixed ertilizers.

Note.—Fertilizers are included in these tables under the final form as sold, so that, for example, cyanamide if converted into sulphate of ammonia, is included under synthetic sulphate of ammonia, or if into ammophos, is included under other synthetic nitrogen.

World Production of Potash Increased

WORLD production of potash increased substantially in 1935 with practically all producing countries sharing in the gain, reports reaching the Department of Commerce indicate. Deliveries of pure potash amounted to around 2,000,000 metric tons during the year, according to estimates, compared with 2,037,000 tons in 1930, the record year, and 1,100,000 tons in 1913.

Contrasted with the marked improvement in most producing countries potash sales by French Alsatian mines declined from the preceding season, due, it is reported, to the severe crisis in French agriculture, and to the inability of fertilizer dealers to extend credit to farmers. With a view to improving the situation the French potash industry has made substantial price reductions during the past two years, a report from Paris states.

WOOD CHEMICAL INDUSTRY AFFECTED BY GROWTH OF SYNTHETIC PRODUCTS

EDITORIAL STAFF

WOOD CHEMICALS principally come from sources other than wood distillation. Synthetic manufacture supplies all of the acetone, 85 per cent of the methanol, and nearly 70 per cent of the primary acetic acid of the United States. This situation has resulted primarily from the fact that wood chemicals are merely co-products with charcoal; hence the output which can be maintained in any works depends far more on ability to sell the charcoal than it does on the market demand for the chemicals themselves.

During 1935 there was a continuation of the uptrend in output of these materials both in the synthetic and in the hardwood distillation divisions of the industry. Record breaking output of rayon and increasing activity on the part of other acetate-using industries stimulated the production of acetic acid. The largest market on record for methanol was experienced, principally in the anti-freeze field and acetone went along with the uptrend despite the fact that its production is no longer in any way interlocked with the others.

During the past year two additional hardwood distillation plants installed equipment for direct recovery of acetic acid. One of these units described in *Chem. & Met.* by Othmer (July, 1935, page 356), began experimental operation during the year but did not produce continuously. The other new equipment has yet to produce significantly at the Clawson Chemical Co. plants, which are near Bradford, Pa.

In the early post-war years, from 5 to 10 million pounds per year of acetone satisfied United States needs. But the demand grew steadily so that in the late twenties approximately 25 million pounds per year were produced. Despite the depression the requirements of the country have grown steadily so that during the last three years they have been, according to *Chem. & Met.* estimates, well in excess of 40 million pounds per annum. All of the United States supply of acetone is made synthetically or by fermentation. It is no longer economical to use calcium acetate as a raw material.

Charcoal Problem

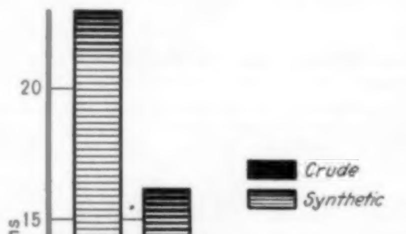
In a large measure the output of chemicals at hardwood distillation plants is governed by the ability of the plant operator to sell the charcoal made. Hence it is very important in the forecasting of wood-chemical trends to appraise the contemporary influences which make for greater or lesser use of charcoal. These have been thoroughly investigated and the following table represents a resumé of the situation in the recent past and the prospective trend in charcoal requirements:

Estimated Distribution of Charcoal by Uses

	Recent Average	Estimated Prospect
	Millions of Bushels	
Charcoal-iron blast-furnace fuel	3	4 to 5
Household and institutional fuel	6	6 to 8
Ditto, as briquets	3	2 to 4
Miscellaneous metallurgical uses	2½	2 to 3
Chemical process industry uses	3½	4 to 5
	18	20

The above estimates ignore two possible factors which might cause larger production: First, any new intensive development of markets by proposed sales campaigns of the industry as a whole. Second, operation of plants for direct recovery of acetic acid regardless of prices obtainable for charcoal. In either case the production of charcoal would be greater than can now be forecast on the basis of measurable trends.

The ratio of charcoal produced to the production of methanol and acetic acid or its equivalent, is reasonably constant for the industry as a whole. Characteristically, a cord of hardwood yields 50 bushels (1,000 pounds) of charcoal, 10.5 gallons of crude methanol (equal to 8.5 gallons of refined 100 per cent), and 110 to 120 pounds of acetic acid or its equivalent in other chemicals. Hence accompanying the production of each million bushels of charcoal one may expect the production of 170,000 gallons of pure methanol and 2,300,000 pounds of glacial acetic acid equivalent (100 per cent). Those who wish to forecast the chemical activity of the hardwood distillation industry have merely to apply these ratios to the anticipated production of charcoal in order to determine the maximum wood-chemical production expected. And the resulting forecast for chemicals will be just as reliable as the charcoal estimates, and no more so.



Production of Crude and Synthetic Methanol, 1931-1935

Methanol

During the past Fall a shortage of methanol developed most unexpectedly because of the amazing increase in anti-freeze demand. Prices stiffened materially, generally advancing about 5c. per gallon. Then a mild season brought a reversal of trends and the prices at the year-end were weak, reverting generally about to the levels which prevailed at the beginning of the season for shipment of anti-freeze. No reliable figures are available as to the prospective total sales for this Winter but the indications are that more methanol will be used than in any previous year. The growth in business is largely at the expense of alcohol. Ethylene glycol as an anti-freeze continues to grow in popularity; but glycerine for this usage is now almost a negligible factor in trade, accounting for something less than a million gallons this year, according to one estimate.

Acetic Acid

Most important among the events of 1935 affecting acetic acid is the cut in tariff made by the President as a result of the new Canadian trade agreement. A concession of ¼c. per pound in the duty was made, on the duty originally 2c. per pound. Some decline in domestic price promptly followed, but complete readjustment to meet the new conditions has not yet been accomplished.

Controversy continues vigorously between interested groups as to the implication of this tariff adjustment. It is freely charged that the main benefit will go to Japanese producers, not to those interested in Canadian production and import. In this connection it is important to remember the fact that such change in tariff benefits all importers except those of countries which have discriminated against the United States or which do not have a most-favored-nation treaty. There is, therefore, some discussion of the possibility of increased import of

acetic acid from low-cost European sources, as well as from the Orient.

Several hardwood distillation plants were dismantled during the past year. At the beginning of 1936 there remain 36 works capable of operation, but at least a half dozen of these have not been operated during the past year and give no evidence of reopening soon. In the aggregate, however, this group of small plants makes up less than 10 per cent of the total capacity of the industry which is now rated at approximately 2700 cords of hardwood per 24-hour day.

The most important business development of the year was the transfer of the Cleveland-Cliffs Iron Co. plant at Marquette, Mich., to the newly established Cliffs-Dow Chemical Co. of which a major control rests with Dow Chemical Co. This enterprise is now largely devoted to manufacture of special chemicals and to activated charcoal for which a large new market is being built up in the field of municipal water-supply treatment. The company also plans additional wood products development in other lines than distillation, notably alcohol manufacture and lignin production by European processes for which American rights have been purchased (see *Chem. & Met.*, June, 1935, page 340). These developments give a new stability to the operations of this particular company as a maker of charcoal, but do not otherwise significantly affect the wood chemicals business.

LARGER SALES AND LOWER PRICES FEATURED TRADING IN SOLVENTS

IN HARMONY with the increase in general industrial conditions, sales of solvents—taking the industry as a whole—reached a larger volume last year than was reported for 1934. Inter-industry competition was keen and the growth in distribution of some solvents was at the expense of some of the other offerings. Hence there not only was no common rate of progression but sales of a few solvents actually were lower than they had been in the preceding year. The new method employed last year of distributing some of the solvents which enter the anti-freeze trade, on consignment so as to retain price control, made it somewhat difficult to distinguish between shipments from producing plants and actual sales made by distributors, especially as some dealers had carry-over stocks from the previous season to dispose of.

While price considerations were of importance in shifting consuming demand from one solvent to another, there were other influences of far greater import. For instance, the use of resins made further inroads in the lacquer industry as applied to automobile finishing. The Ford company, which was the pioneer in using the resin type lacquer on its cars, was followed last year by the makers of Plymouth cars and some of the Dodge models also were finished with that type coating. This accounts for an increase in consumption of naphtha in the lacquer trade but it reacts unfavorably on demand for butyl and amyl alcohols in that direction.

A gain of nearly 20 per cent in output of artificial leather—for which replacement of street cars by buses was partly responsible—had a stimulating effect on the movement of solvents used in that field.

Considerable progress also was made in the development of lacquer for use on paper and in the commercial applications of nitro-cellulose emulsions. Both these developments, however, are in their early stages and are of interest more from the promise they hold out than because of their present prominence.

In addition to an increase last year in consumption of glyptal type resins, there also was a wider demand for Vinyl type resins which found their way into numerous special uses with prospects favoring a more extensive use in the present year. Resin lacquers themselves are meeting competition from a new high solid type lacquer which is a combination between synthetic resins and nitro-cellulose, having practically the same solid content as resin solutions and can be applied with greater facility.

One of the important developments of the year in the solvent industry was the increase in productive capacity largely due to the introduction of new producers. In spite of the enlarged outlet for solvents last year, the marking up of production resulted in an over-supply which in turn encouraged sales competition of a price-cutting nature and the general price trend was downward.

There was no important litigation within the industry during the last year but interest was wide-spread in a court action which was favorable to the Paramet Co. of Brooklyn in a suit brought against producers of glyptal type resins and there is considerable speculation regarding its effect on resins if the decision is upheld by the higher courts.

Ethyl Alcohol

Reporting for the fiscal year ended June 30, 1935, the Bureau of Internal Revenue states that the alcohol industry continued the recovery of the previous year. Production of ethyl alcohol amounted to 180,645,920 proof gal. compared with 165,103,582 proof gal. for 1934 which represents a recovery to approximately 90 per cent of the 1929 level.

The increase in consumption, however, was greater than the increase in production. Withdrawals of ethyl alcohol on payment of tax amounting to 16,990,972 proof gal., increased by 836,358 proof gal. over the preceding year. Withdrawals for tax-free purposes amounted to 166,104,787 proof gal. or an increase of 26,106,879 proof gal. over the 1934 fiscal period. The greater part of the increase in tax-free withdrawals was due to larger amounts denatured.

The summary places production of denatured alcohol at 97,031,074 wine gal. and withdrawals at 96,703,993 wine gal. Of the withdrawals, 38,050,525 gal. had been completely denatured and 58,653,468 gal. had been specially denatured. The consumption of specially denatured continued to exceed that of completely denatured.

Five new alcohol plants were authorized and began operations during the 1935 fiscal year, one each in Colorado, Indiana, Kansas, Ohio, and Pennsylvania. Seven plants which had operated in 1934 were either discontinued or failed to operate in 1935. Compared with 1934, more alcohol was produced from molasses and less was produced from grain.

Alcohol Produced at Industrial Plants and Withdrawals for Denaturing

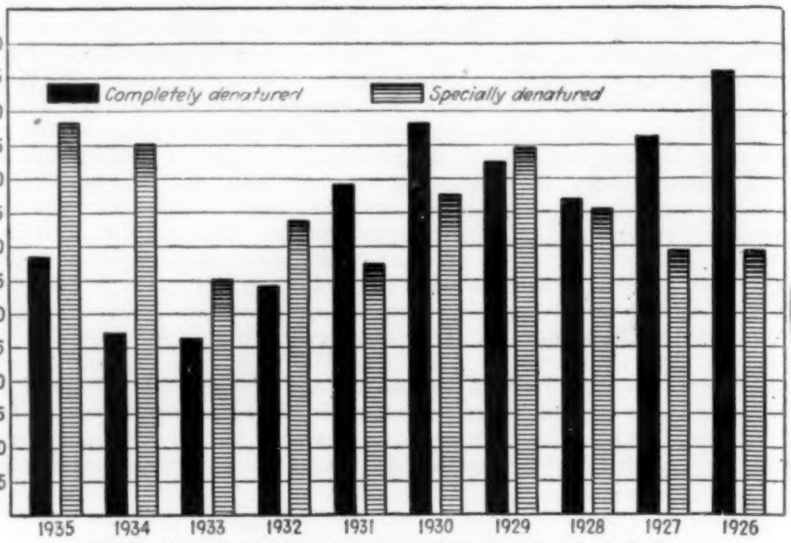
Fiscal Year	Alcohol Produced, Proof Gal.	Ethyl Alcohol Withdrawn for Denaturation, Proof Gal.	Denatured Alcohol Produced		
			Completely, Wine Gal.	Special Wine Gal.	Total, Wine Gal.
1922	79,906,101.50	59,549,919.6	16,193,523.60	17,152,224.31	33,345,747.91
1923	122,402,849.81	105,819,404.9	27,128,229.54	30,436,913.14	57,565,142.68
1924	135,897,725.83	121,576,196.1	34,602,003.72	33,085,292.04	67,687,295.76
1925	166,165,517.81	148,970,220.9	46,983,969.88	34,824,303.28	81,808,273.16
1926	202,271,670.32	191,670,107.2	65,881,442.43	39,494,443.80	105,375,886.23
1927	184,323,016.97	170,633,436.7	56,093,748.16	39,354,928.48	95,448,676.64
1928	169,149,904.83	159,689,378.2	46,966,601.28	45,451,424.28	92,418,025.56
1929	200,832,051.08	182,778,966.1	52,405,451.92	54,555,006.15	106,960,458.07
1930	191,859,342.42	181,601,420.3	58,141,740.88	47,645,796.84	105,787,537.72
1931	166,014,346.15	149,303,438.5	49,136,200.64	37,172,740.71	86,308,941.35
1932	146,950,812.76	132,578,234.7	34,298,235.54	44,031,281.80	78,329,517.34
1933	115,609,754.29	103,753,240.7	26,254,230.80	35,076,115.90	61,600,346.70
1934	165,103,582.00	137,416,765.0	27,174,311.00	55,067,092.00	82,241,403.00
1935	180,645,920.00	163,009,786.0	38,746,679.00	58,284,395.00	97,031,074.00

For the calendar year 1935, the amount of alcohol withdrawn tax-free was 20,737,183 proof gal. or about 17.7 per cent higher than similar withdrawals of 17,617,211 proof gal. for the calendar year 1934. This bears out reports that sales of alcohol for beverage purposes were on a larger scale in the latter part of last year.

Production of denatured alcohol in the 1935 calendar year was 97,389,853 wine gal. compared with 95,399,288 wine gal. for the 12 months of 1934. The 1935 output was divided, 61,800,295 wine gal. for specially denatured and 35,589,558 wine gal. for completely denatured. These totals indicate that the trend toward the specially denatured product still continues as the 1934 output was composed of 56,849,841 wine gal. of specially denatured and 38,549,447 wine gal. of completely denatured.

Consumption of denatured alcohol in 1935 can not be so definitely placed as can production. It is safe to say that there was an increase in sales of specially denatured but completely denatured up to the end of December had made an unfavorable showing. This is accounted for by the relatively poor showing made by the anti-freeze trade. In the first place, weather conditions were not conducive to sales of anti-freeze products—a condition which has changed materially since the turn of the year—and a large carryover of dealer stocks had to be liquidated. In addition competing products, especially methanol and ethylene g'ycol, had a good season which further contracted the anti-freeze market for denatured alcohol.

Earlier in the year, a majority of the alcohol companies changed their marketing policies with regard to anti-freeze alcohol. They adopted a plan of consigning stocks to distributors at a controlled retail price, allowing jobbers, fleet owners, and oil companies quantity discounts from the retail price. As a result of this plan the retail price held up well until December when price-cutting began to appear and finally the price schedule was openly revised with the abolition of the rise which had been put into effect at the beginning of the season. This gave an uncertain price tone to the entire denatured market and the year closed with all grades in a weak price position.



Production of completely and specially denatured alcohol

Higher Alcohols and Acetates

Consuming demand for butyl alcohol was slightly greater than it had been in 1934. It entered the year with values strongly entrenched but again new production entered as a factor and brought about a downward revision of sales prices. One producer who had closed the butyl alcohol division of his plant again re-entered the field and a new producer started to function in New Jersey.

Ethyl acetate was spotty throughout the year partly because of an increase in the use of isopropyl acetate.

Methyl ethyl ketone was in limited supply as one factor was not in production a good part of the year and the other producer had his output sold ahead. The uses of secondary alcohols and acetates continued to increase.

Acetone

Acetone was again favored with an increase in sales and from a purely tonnage standpoint had one of its best years. The rapid strides made by cellulose acetate in the plastic field had a stimulating effect on the movement of acetone into consumption. The strong price position held at the opening of the year, however, was unable to withstand the increase in competition which new production brought into the market and the openly quoted prices were not adhered to in transactions in the latter part of the year.

Operations at Ethyl Alcohol Plants
Fiscal Years, 1934-1935

	1934 Proof Gal.	1935 Proof Gal.
Production	165,103,582	180,645,920
Removed to bonded warehouses[1]	164,734,591	180,831,628
Withdrawals, total[1]	156,152,522	183,095,759
Tax-paid	16,154,614	16,990,972
Tax-free, total	139,997,908	166,104,787
For denaturation[1]	137,416,765	163,009,786
For hospital and scientific use	1,404,198	1,496,283
For use of U. S. and subdivisions	793,803	852,615
For export	128,470	117,500
For medicinal and beverage use in Puerto Rico	254,672	628,603
Losses in warehouses	490,854	491,226
Losses in transit	23,156	64,041
Stocks in bonded warehouses June 30[2]	27,970,640	25,252,756
Materials Used		
Molasses, gal.	170,331,275	187,849,299
Grain		
Corn, lb.	141,472,143	65,922,466
Malt, lb.	21,714,922	14,134,676
Rye, lb.	2,108,920	3,837,630
Ethyl sulphate, gal.	9,567,650	13,698,550
Hydrol, lb.	23,084,171	28,245,237
Pineapple juice, gal.	7,491,397	5,316,620
Fermented liquor, gal.	1,672,109	1,190,183
Corn syrup, lb.	672,170	....
Miscellaneous, lb.	49,510	1,850

[1]Including 148,218 proof gallons in 1934 and 41,847 proof gallons in 1935 removed directly to denaturing plants by alcohol plants not having a bonded warehouse.

[2]Stocks in transit between bonded warehouses and quantities in receiving tanks of alcohol plants awaiting transfer to bonded warehouses not computed.

Production of Completely Denatured Alcohol, Formulas No. 1, 5, and 10, and Specially Denatured Alcohol, Formula No. 1, and Consumption of Denaturing Grade Wood Alcohol and Tecsol as Denaturant (gallons)

Fiscal year ending June 30	Completely denatured alcohol No. 1 Production	Completely denatured alcohol No. 1 Wood alcohol used	Completely denatured alcohol No. 5 Production	Completely denatured alcohol No. 5 Wood alcohol used	Specially denatured alcohol No. 1 Production	Specially denatured alcohol No. 1 Wood alcohol used	Completely denatured alcohol No. 10 Production	Tecsol used
1919	7,180,520	653,000	....	....	4,402,655	210,030	....	....
1920	6,926,825	630,000	3,679,944	71,500	6,563,351	312,000	....	....
1921	50,420	4,580	6,496,719	126,000	3,993,825	190,000	....	....
1922	166,215	15,100	9,843,651	191,000	4,994,240	238,000	....	....
1923	445,833	40,500	18,809,225	366,000	7,195,023	342,500	....	....
1924	481,246	43,700	25,762,998	501,000	7,067,676	336,000	....	....
1925	1,056,072	96,000	36,079,786	700,000	7,165,123	341,500	....	....
1926	4,508,806	410,000	47,892,920	932,500	7,495,270	356,500	....	....
1927	5,289,766	481,000	47,038,093	[1]1,182,800	7,617,904	360,000	....	....
1928	7,502,784	684,000	40,383,574	1,534,770	7,787,848	370,500	....	....
1929	9,747,970	885,000	41,619,878	1,581,750	9,044,310	430,000	....	....
1930	9,910,049	901,000	47,237,603	1,795,250	7,399,350	352,000	....	....
1931	[2]7,588,294	62,500	41,529,484	[3]1,124,000	7,593,947	357,000	....	....
1932	13,040	1,185	....	....	[4]14,337,252	682,500	....	....
1933	....	....	....	....	10,850,540	516,000	1,692,382	76,925
1934	....	....	....	....	15,164,589	722,100	14,160,300	643,650
1935	....	....	....	....	15,803,575	752,600	32,215,688	1,464,350

[1]Methanol content changed from 2 to 4, Jan. 1, 1927.
[2]Suspended as of Jan. 1, 1931.
[3]Methanol dropped from formula as of Jan. 1, 1931.
[4]When C.D.A. No. 1 was suspended there was authorized a proprietary solvent based on S.D.A. No. 1.

CARBON BLACK GAINS

By I. Drogin

CHIEF CHEMIST

J. M. HUBER, INC., NEW YORK, N. Y.

CARBON BLACK is important as a reinforcing pigment in rubber stock and as a color pigment in printing ink, paint, lacquer, varnish, phonograph records and black polishes. Sales both here and abroad for the past seven years are shown in accompanying tables. Of the 211,000,000 lb. of carbon black sold last year in the United States, approximately 86 per cent was for rubber, 8 per cent for printing ink, 3 per cent for paint and the remainder for miscellaneous purposes.

Carbon black is produced from natural gas either by burning it through lava tips in a limited supply of air and causing the flames to impinge on a relatively cold surface, by thermally decomposing the gas, or by simply burning the gas with a regulated amount of air and collecting the smoke. There are at present in the United States six commercial methods for producing carbon black. Of these the Channel process is the most important. In 1935 close to 310,000,000 lb. were produced by this process, while 40,000,000 were produced by all other processes.

The first commercial factory for producing carbon black was established in 1872 in New Cumberland, W. Va. Natural gas was then burned against slabs of soap stone, which was used as a condensing surface and the black was scraped off. The Channel process was patented in 1892 by L. J. McNutt and use of the product spread to other industries.

The rubber industry last year consumed approximately 182,000,000 lb. of black. From 3.3 to 11.9 lb. of black are now required per tire. Size, design and number of plies of the tire determine the weight of black to be used.

The printing ink industry last year used approximately 17,000,000 lb. of black. Printing inks require from 8 to 30 per cent black, depending on the printing job: Newsprint inks from 8 to 12 per cent, job inks from 15 to 25 per cent, half-tone inks from 15 to 25 per cent, lithographic inks from 20 to 30 per cent. A little black will go a long way in printing ink. For instance, one pound of newsprint ink will usually print about 4,000 newspaper pages and the legibility is attained with about 1.6 ounces of black per lb. of ink.

The world production of carbon black over the period of the past seven years is shown in an accompanying table. The United States accounts for most of the world production, and Russia and Japan produce small amounts. Naturally, this country carries on a brisk export trade.

The carbon black industry depends on a plentiful supply of natural gas available at a very low price. As soon as there is a demand for this gas for industrial and domestic purposes, the carbon black producer must seek a new gas supply. This condition is responsible for the industry being a migratory one. It has migrated steadily south westward, first in Pennsylvania, then in West Virginia, the Monroe gas field in North Louisiana, Kentucky, the Breckenridge and Caddo gas fields in Texas, Oklahoma, Utah, Montana, and Wyoming. And now the bulk of the industry is centered in the Panhandle district of North Texas where approximately 85 per cent of the carbon black is produced.

When carbon black was first produced, it sold for about $2.58 per lb. At the present time the average grade of black sells for from 4 to 8c. per lb., depending on type of packing and place of delivery. There are some jet blacks which are quoted as high as $1.10 per lb. The price a carbon black producer has to pay for natural gas depends upon several conditions; namely; the distance to the source of supply, the sourness or sweetness of the gas and also its natural gasoline content. The current price ranges around 3c. per M. cu.ft.

Table 1—Domestic Sales of Carbon Black ([2])

Millions of Pounds

Industries	1929	1931	1932	1933	1934	1935([3])
Rubber	138.5	134.3	130.4	191.4	165.4	182.0
Ink	27.3	15.2	18.3	18.5	16.2	17.5
Paint	17.3	6.8	7.6	6.3	5.4	5.9
Misc	8.9	5.4	5.1	6.2	5.0	5.5
	192.0	161.7	161.4	222.4	192.0	210.9

([2]) Mineral Resources of the U. S., 1931; Minerals Yearbook, 1934; Mineral Markets Reports, May 9, 1935.
([3]) Estimated.

Table 2—Export Sales of Carbon Black from the United States ([2])

Millions of Pounds

	1929	1931	1932	1933	1934	1935 ([3])
Australia	5.71	1.92	4.05	5.12	7.72	5.67
Belgium	2.26	2.90	3.35	5.38	3.45	3.80
Canada	13.89	9.83	6.98	10.58	9.55	12.40
China	1.05	1.05	1.33	2.03	1.16	1.54
France	16.70	18.04	19.46	32.42	22.73	17.37
Germany	14.05	14.41	16.22	20.33	16.50	23.44
Italy	2.54	2.81	3.39	7.20	4.48	9.92
Japan	5.11	6.31	6.00	9.34	3.46	7.85
Netherlands	2.00	1.59	2.42	6.69	1.93	4.57
United Kingdom	23.27	32.28	31.06	42.60	37.91	39.13
Other countries	5.24	5.59	5.81	10.61	8.86	13.76
Total	91.82	96.73	100.07	152.30	117.75	139.45

([2]) Mineral Resources of the U. S., 1931; Minerals Yearbook, 1934; Mineral Markets Reports, May 9, 1935.
([3]) Estimate based on Dept. of Commerce figures for first 11 months.

Table 3—Production of Carbon Black from Natural Gas ([2])

	1929	1931	1932	1933	1934	1935 ([3])
Number of Producing factories	71	58	50	50	50	50
Pounds Produced (Millions)						
Louisiana	127.35	57.49	42.26	54.47	66.54	40.
Texas	228.18	210.88	200.44	214.86	262.29	310.
Other States	10.92	12.54	*	*	*	......
	366.45	280.91	242.70	269.33	328.83	350.

* Oklahoma and Wyoming production included with Texas.
([2]) Mineral Resources of the U. S., 1931; Minerals Yearbook, 1934; Mineral Markets Reports, May, 1935.
([3]) Estimated.

Table 4—Production of Carbon Black from Natural Gas ([2])

Millions of Pounds

Years	Channel Process	Other Processes
1929	327.55	38.89
1931	255.32	25.59
1932	224.54	18.16
1933	234.23	35.10
1934	293.55	35.28
1935 ([3])	350.00	40.00

([2]) Mineral Resources, of U.S., 1931; Minerals Yearbook, 1934; Mineral Markets Report, 1935.
([3]) Estimated.

Table 5—Volume of Natural Gas Used for Production of Carbon Black

Millions—cu.ft	261.11	195.40	168.24	186.78	229.93	244.75
Yield—Pounds black per M cu.ft	1.40	1.44	1.44	1.44	1.43	1.43

CHEMICALS USED IN PULP AND PAPER PRODUCTION

By James A. Lee
CHAIRMAN, NON-FIBROUS RAW MATERIALS COMMITTEE
TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY

THE production of pulp and conversion to paper require a variety of chemicals, as is indicated in this article, which is based on a report of the Non-Fibrous Raw Materials Committee to the Technical Association of the Pulp and Paper Industry. The report does not attempt to cover every chemical employed; however, most of the leading materials are discussed.

The consumption of caustic soda by the paper industry has kept in step up to 1934 with the total output of this chemical. It is expected that the consumption of caustic by the pulp and paper industry will increase not only because of improved business but because it is finding use as a neutralizing agent in the multi-stage chlorine bleaching processes, which will be used to a greater extent.

Notwithstanding the substantial inventories in the hands of manufacturers of this commodity, the price structure for it has remained relatively stable for contracts for delivery throughout 1936, and it is apparent that the rate of increase in consumption will shortly liquidate any excess stocks that may be overhanging the market.

Chlorine

The use of chlorine in the paper industry in 1935 has not been appreciably affected by multi-stage bleaching employing both chlorine and hypochlorite. Such processes by themselves consume less chlorine, but such lessened consumption appears to have been taken up substantially by increased bleaching of sulphite replacing imported bleached pulp and by the increasing domestic production of bleached kraft.

The steady increase in the use of chlorine or chloramine in the treatment and prevention of paper mill slimes, while not providing much tonnage, is of technical importance. It appears to date to be the answer not only to slimes, but to white water recovery with closed systems and the abatement of stream pollution. Paper mill slimes are to some degree related to general water and sewage problems, in which fields chlorine plays an important part.

The increase in output of newsprint and the increased consumption of sulphur in kraft production have been reflected in sales of the commodity. A larger outlet for sulphur may be expected if the development in the Southern pulp and paper industry gets under way in earnest. Prices have remained unchanged.

During the year some interest was shown in a process to produce sulphur from Canadian pyrites. This process, which is based upon chlorination, is being tested by Sulphide Corp. and Hooker Electrochemical Co.

The production curves for alum show an increase in 1935 reflecting increased activity in the paper field. Price trends during the year remained firm, although it is well to bear in mind that there have been several developments which may have a disturbing influence on future price trends.

The first of these concerns reported a definite shortage of high-grade aluminum oxide ores, due mainly to technical developments which have increased the use of the metal and its alloys. This development is by no means alarming and presaging any shortage of aluminum oxide ores, but concerns the influence that this may have in causing developments of lower grade ores and the consequent effect of higher production costs. Counterbalancing this disquieting news has been the technical development within the paper industry showing the harmful effects of acidity in the sheet introduced by the use of alum, and its possible effect upon future total alum consumption.

The second development tends to eliminate entirely the use of alum, particularly in those cases where alum has been used to overcome pitch difficulty. These latter two developments are merely a step in the progress of the technical branch of the paper industry leading to a more intelligent use of raw materials.

The volume of silicate of soda consumed during the past year has remained stable. The year has been fruitful in the production of a wider knowledge of sodium silicates and their uses. New applications have been developed, among which should be mentioned the use of silicates modified by the addition of fillers, by which improvements in economy of operation and quality of product are being made available to the fiber box industry.

The trend toward products of greater opacity, and better color and brightness, has resulted in a continued demand for zinc pigments. Zinc oxide has only been used in coating formulas. The zinc sulphide pigments have been used for coating, also, and quite generally as fillers. With four types of zinc sulphide pigments available, there has been a considerable program of testing by paper mills.

The use of titanium pigments by the paper industry has increased rapidly during the past few years. The manufacturers of these products have now developed pigments with properties that make them suitable for use either in the beater or for application to the surface of papers by the ordinary coating process or processes in which the pigment is applied during the primary paper making operation. These pigments are now being used in papers or boards where high opacity or brightness is of prime importance. The volume now being annually consumed has reached a figure which definitely establishes these pigments as important raw materials in the manufacture of several different types of paper.

Casein

The price of casein during 1935 fluctuated from a low of 10c. per lb., reached in August, to a high of 15c. per lb., which prevailed during the greater part of December. Purchases were at a high level during the last quarter of the year when supplies of domestic casein were below normal.

Starch continues to play an important part in the paper industry, where it is used in beaters, tubs and calender stacks. Prices of corn starch remained firm until November, when the new corn crop became available. Special paper-making starch closed the year at $2.79 per 100 lb. in bags, Chicago, declining from the high of $3.25 earlier in the year. High-grade tapioca firmed up during the year and closed in this position.

During 1935, there was very little change in the prices of dyestuffs used in the paper industry. Most prices remained unchanged, and where changes occurred the tendency was to slightly higher levels; increased costs were in most instances absorbed by the dyestuff manufacturer. The consumption of dyestuffs has been very well sustained throughout the year.

The increase in consumption of refined paraffine wax was no doubt due to improved business conditions. No outstanding new uses were developed during the year. During the past few months amorphous mineral waxes found an increasing demand in the paper industry for use as a sizing material and for laminating purposes. Considerable quantities of petrolatum and white mineral oils were used in the manufacture of specialty papers.

CONSUMPTION OF CERTAIN INORGANIC CHEMICALS IN COAL-TAR TRADE

THE Tariff Commission report for 1934 for the first time contained statistics on the consumption of certain inorganic chemicals used in the production of coal-tar products. Most of the data were compiled from reports of 132 domestic producers, representing more than 90 per cent of the output in 1934, the remainder being estimated. In certain instances the figures are estimates based on ratios of actual consumption of inorganic chemicals by several representative producers of coal-tar products.

The list, of course, is not complete; the total shown is far less than the actual consumption of raw materials by this industry. For example, in addition to the figures shown, it is estimated that more than 2,000,000 lb. each of dextrine, talc, and sugar, 3,500,000 lb. of carbon dioxide, and 1,500,000 lb. of glacial acetic acid was used in production of coal-tar products in 1934.

Other materials consumed in appreciable quantities were chloro-acetic acid, chlorosulphonic acid, oxalic acid, phosphoric acid, tannic acid, boric acid, acetic anhydride, aceto acetic ester, acetone, butyl alcohol, alum, ammonium chloride and sulphate, antimony trichloride, barium chloride, bromine, charcoal, carbon disulphide, carbon tetrachloride, corn starch, copper powder, formaldehyde, glycerine, magnesium oxide, mercury, nickel powder, phosgene, phosphorus oxy and trichlorides, sodium bicarbonate, sodium chlorate, sodium cyanide, sodium phosphate, sodium sulphohydrate, sodium tungstate, metallic sodium, filter cel, zinc chloride, and rosin.

There were 43 producers of dyes in 1934, reporting an output of 87,177,612 lb., or 14 per cent less than in 1933 and 7 per cent less than the average for the period 1925-30. A corresponding decrease in sales volume and a slight increase in sales value of dyes is shown. The unit value of sales of all dyes increased to $0.51 per lb. as compared with $0.44 per lb. in 1933. The decrease in volume and the increase in the unit value of sales are due principally to decreased sales of the low-priced tonnage products—indigo and sulphur black. The output of indigo declined from 23,412,400 lb. in 1933 to 15,818,492 lb. in 1934, or 32 per cent, while that of sulphur black decreased from 16,020,531 lb. to 9,790,047 lb. These decreases are attributed to the building up of stocks in the preceding year in anticipation of increased prices and to decreased exports to China. Our exports of dyes to China decreased from 11,591,637 lb. in 1933 to 8,373,975 lb. in 1934.

Sales of new and unclassified dyes increased from 7,734,981 lb. valued at $7,794,740 in 1933 to 8,700,743 lb. valued at $8,961,992 in 1934. Activity in this group reflects new developments. Outstanding in the year were the increased variety and volume of dyes for acetate silk, rayon, and resins, and the many new shades for textiles.

In the synthetic organic chemical group, the production of resins derived from phenol and cresol reached an all-time peak of 40,663,565 lb. in 1934 or 28 per cent more than in the preceding year. Resins derived from phthalic anhydride increased 53 per cent in output with sales of 7,084,602 lb. valued at $1,022,436 as compared with 3,654,854 lb. valued at $673,890 in 1933. Commercial production of resins derived from styrol, from xylenol, and sulphonamide was reported for the first time in 1934. Cast phenolic resins are shown separately for the first time in the report for 1934.

Inorganic Chemicals Consumed in Manufacture of Coal-Tar Products, 1934

	Strength	Consumed lb.
Alkalis:		
Ammonia	anhydrous	6,714,000
Caustic soda	76 per cent	127,362,000
Caustic potash	90 per cent	4,789,000
Lime[1]	hydrated	10,314,000
Soda ash	58 per cent	40,814,000
Calcium carbonate[1]	tech.	21,330,000
Acids:		
Hydrochloric	18 deg. Bé	134,782,000
Nitric	40 deg. Bé	28,866,000
Mixed	....	46,315,000
Sulphuric	66 deg. Bé	207,583,000
Other:		
Aluminum chloride	100 per cent	3,964,000
Calcium chloride[1]	tech.	3,780,000
Chlorine	100 per cent	117,182,000
Copper sulphate[1]	crystals	2,284,000
Ferrous chloride[1]	tech.	1,696,000
Ferrous sulphate[1]	tech.	3,132,000
Iron borings[1]	....	129,341,000
Sodium acetate[1]	tech.	2,624,000
Sodium bichromate[1]	tech.	2,484,000
Sodium chloride[1]	tech.	177,842,000
Sodium nitrite	tech.	6,954,000
Sodium sulphate[1]	tech.	3,726,000
Sodium sulphide	fused	4,495,000
Zinc dust[1]	....	17,410,000
Total		1,105,783,000

[1]Estimated.

Production and Sales of Dyes and Coal-Tar Chemicals

	Number of manufacturers	Production	Sales		
			Quantity	Value	Unit value
		Pounds	*Pounds*		
Intermediates	64	407,727,846	174,663,573	$27,033,009	$0.15
Finished products—total[1]	179	186,981,910	167,632,277	76,214,233	.45
Dyes:					
Classified	....	77,512,748	75,608,302	34,288,623	.45
Unclassified	....	9,664,864	8,700,743	8,961,992	1.03
Total	43	87,177,612	84,309,045	43,250,615	.51
Color lakes	38	8,114,865	7,839,562	5,805,107	.74
Photographic chemicals	9	996,052	829,002	957,508	1.16
Medicinals	39	10,023,626	8,224,416	7,921,529	.96
Flavors	14	1,903,132	1,812,234	1,928,892	1.06
Perfume materials	24	2,264,774	1,883,195	1,098,971	.58
Resins[1]	54	56,059,489	43,350,876	10,126,849	.23
Miscellaneous[2]	33	20,442,360	19,383,947	5,124,762	.26

[1]Does not include resins derived from coumarone and indene and from sulphonamide.
[2]Includes benzoate of ammonia, benzoate of soda, benzoyl peroxide, biological stains and chemical indicators, diazo salts, poisonous and tear gases, synthetic insecticides, naphthol A S series, rapid fast and rapidogene colors, synthetic tanning materials, textile assistants, and others.

Comparison of Production and Sales of Dyes and Coal-Tar Chemicals

	1925–30 average	1933	1934	Increase 1934 over 1933 per cent
Intermediates:				
Production, 1,000 lb.	267,492	370,754	407,728	10.0
Sales, 1,000 lb.	109,133	163,683	174,664	6.7
Sales value, $1,000	22,408	23,705	27,033	14.0
Finished coal-tar products[1]:				
Production, 1,000 lb.	138,078	[2]176,206	[3]186,982	6.1
Sales, 1,000 lb.	133,964	[2]162,092	[3]167,632	3.4
Sales value, $1,000	65,027	[2]68,993	[3]76,214	10.5
Dyes:				
Production, 1,000 lb.	94,003	100,953	87,178	[4]13.6
Sales, 1,000 lb.	92,207	98,238	84,309	[4]16.2
Sales value, $1,000	39,428	43,102	43,251	.3
Medicinals:				
Production, 1,000 lb.	4,508	8,715	10,024	15.0
Sales, 1,000 lb.	4,106	8,070	8,224	1.9
Sales value, $1,000	7,464	6,828	7,922	16.0
Flavors and perfume materials:				
Production, 1,000 lb.	3,966	3,159	4,168	31.9
Sales 1,000 lb.	3,919	2,965	3,695	24.6
Sales value, $1,000	2,901	2,484	3,028	21.9
Resins:				
Production, 1,000 lb.	[5]24,442	[2]41,628	[3]56,059	34.7
Sales, 1,000 lb.	[5]22,135	[2]31,658	[3]43,351	36.9
Sales value, $1,000	[5]7,756	[2]7,239	[3]10,127	39.9

[1]Includes color lakes, photographic chemicals, and miscellaneous coal-tar products not shown separately.
[2]Does not include coumarone and indene resins.
[3]Does not include coumarone and indene and sulphonamide resins.
[4]Decrease.
[5]1927-30 average.

SALES OF EXPLOSIVES DECLINED IN VOLUME LAST YEAR

REPORTING on domestic production of explosives for the calendar year 1934, the U. S. Bureau of Mines stated that the output of explosives for industrial use during that year continued the upward trend begun in 1933 from the low-level point reached in 1932 and production in 1934 was only slightly less than in 1931.

Reduced to figures, the report places the quantity of explosives manufactured and sold in 1934 at 314,767,922 lb., 23 per cent more than in 1933, 35 per cent more than in 1932, and 7 per cent less than in 1931.

Coal-mining operations were the chief consumers of permissible explosives; 99 per cent of the total output in 1934 was used in coal mines. The proportion used by bituminous mines was 59 per cent and by anthracite mines 40 per cent. Coal mining was likewise the principal consumer of black blasting powder, taking 88 per cent of the total sales during 1934; of this proportion, bituminous mines received 78 per cent and anthracite mines between 9 and 10 per cent. Consumers of high explosives other than permissibles were more varied; the reports showed that 11 per cent of the total quantity sold was for coal mining, 22 per cent for metal mining, 17 per cent for quarrying and nonmetallic-mineral mining, 46 per cent for railway and other construction work, and 4 per cent for all other purposes.

In 1935, the upward trend to production and sales was checked. While some branches of the building trades reported progress there was a decline in the heavy type of construction which offers a good outlet for explosives. The largest consuming industry, coal-mining, also cut down its requirements with the anthracite field leading the decline. The poorest showing was made in the early part of the year with a rising trend in the latter half of the year closed with a promising outlook for the immediate future. Sales for the year were approximately 285,000,000 lb.

Productive capacity of domestic plants is considerably higher than the demands made by consuming trades as may be seen from the fact that in 1934, mills at which black blasting powder was made, were operated at only 38.9 per cent of their rated capacity and plants turning out permissibles and other high explosives were worked at only 44.6 per cent of capacity. The seasonal nature of the business, however, accounts in part for this condition as plants must be geared to meet requirements in peak months.

The tendency to broaden the field for high explosives has brought about an increase in such plant capacity during recent years with a more or less corresponding decrease in plant capacity for black powder with the result that many powder mills have been abandoned in recent years and capacity in 1934 was less than in any recent year.

Estimated Quantities of Certain Materials Used in Explosives Consumed in 1934

Materials	1934 Black powder lb.	1934 Permissibles lb.	1934 Other high explosives lb.	1934 Tota lb.	1933 tota lb.
Sulphur	8,962,000	....	4,289,000	13,251,000	11,661,000
Charcoal	10,340,000	....	....	10,340,000	9,632,000
Sodium nitrate	49,633,000	2,332,000	82,306,000	134,271,000	111,846,000
Nitroglycerin	....	3,767,000	60,184,000	[1]63,951,000	[1]49,806,000
Nitrotoluenes	....	....	1,289,000	1,289,000	993,000
Nitrocellulose	....	....	687,000	687,000	536,000
Ammonium nitrate	....	25,651,000	22,024,000	47,675,000	39,021,000
Antacid	....	179,000	1,441,000	1,620,000	1,263,000
Wood pulp	....	2,556,000	12,438,000	14,994,000	11,765,000
Paper	....	1,666,000	6,333,000	7,999,000	6,326,000
Paraffin	....	1,666,000	5,073,000	6,739,000	5,349,000
Total	68,935,000	37,817,000	196,064,000	302,816,000	248,198,000
Absorbents other than wood pulp, moisture, and other compounds	....	1,391,000	10,561,000	11,952,000	7,789,000
Total sales	68,935,000	39,208,000	206,625,000	314,768,000	255,987,000

[1]Nitroglycerin contains nitroglycerin, nitropolyglycerin, nitrosugar, and ethylene glycol dinitrate (approximately 13,500,000 pounds in 1934).

INCREASED USE OF FLUORINE IN REFRIGERANTS

MANUFACTURE of refrigerants and other fluorine chemicals now requires more fluorspar than even the ceramic or glass industries. In the aggregate the chemical needs are about equal to all the ceramic requirements, though these chemical process uses are in total much less than the metallurgical requirements. They do, however, demand higher grade mineral raw material.

Steady increases have occurred in recent years in the use of fluorine refrigerants and to a lesser degree to other hydrofluoric acid or fluorine compounds. This trend continued strongly into 1935 and it is anticipated that a still further increase in fluorine for refrigeration will make 1936 a record year. *Chem. & Met.* estimates that about 3.5 million pounds of these fluorine refrigerants were sold last year and estimates from the trade imply a 4.0 million pound market in 1936. This refrigerant, commonly called F-12, is in use today probably to the extent of 6.5 million pounds. It contains approximately 32 per cent by weight of fluorine.

Air conditioning developments account in large measure for the more optimistic prospects in the market for all refrigerants. Wall Street talks about air conditioning as a business amounting to $500,000,000 per year. But apparently that total is yet to be reached, though it is distinctly within the range of possibilities within the next few years.

Official estimates indicate that the use of fluorspar in the United States during recent years is greater for the making of hydrofluoric acid and its derivatives than for any other application except in the basic open-hearth steel industry. In 1934 about 11,000 short tons of fluorspar were so used, roughly 10 per cent of the total consumption of the country. Approximately 75 per cent of the total consumption is employed for open-hearth steel making. The following table from a recent report of the Bureau of Mines summarizes these uses in short tons of spar consumer in 1934.

Basic open-hearth steel	81,000
Hydrofluoric acid and derivatives	11,000
Glass	7,700
Electric furnace steel	4,300
Enamel and vitrolite	3,500
Foundry	1,600
Miscellaneous	1,000
Ferro-alloys	500

Of the total supply used in the United States, domestic producers provided about 85 per cent. Imports, mainly of spar containing 97 per cent or more CaF_2, supplied the balance.

Census data for 1933 indicate the production of fluorine compounds in that year as follows:

Hydrofluoric acid	4,167,000 lb.
Hydrofluosilicic acid	3,730,000 lb.
Sodium silicofluoride	1,411,000 lb.

Numerous other fluorine compounds are, of course, produced, but not separately reported by the Census, since the publishing of data would violate rules regarding revealing information of individual producers to one another or to the public.

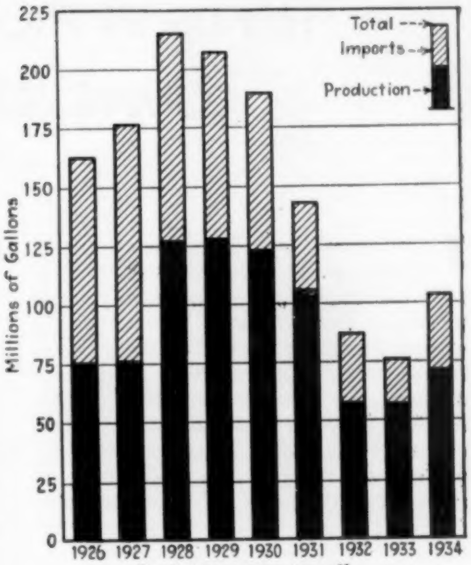
GAS AND COAL PRODUCTS IN 1935

BYPRODUCT coke and related coal products were made during 1935 at a rate of approximately 11 per cent higher than during the preceding year. Behive operations were just 10 per cent below 1934. As a whole, the coke industry processed 51.0 million tons of coal to make 35.2 million tons of coke. Of the total, 97.3 per cent was byproduct business and only 2.7 per cent (an all-time low) was behive activity.

During the year 81 byproduct plants operated; 40 of these were coke works affiliated with the steel industry, and these establishments did nearly 20 per cent better in total tonnage than during the previous year. The other half of the works, which are merchant enterprises not connected with steel companies, but often connected with public utilities, operated at a little lower capacity than during the preceding year. Of those works operating, 77 recovered ammonia and 52 made either motor benzol or refined benzol and related products. The estimated output of coal products in 1935, as calculated by the United States Bureau of Mines, was:

Tar produced.........455 million gal.
Gas produced, including fuel
used under battery...549 billion cu.ft.
Crude light oil made....129 million gal.
Benzol produced........79 million gal.
Ammonium sulphate or equivalent produced......532 thousand tons

During the year one new installation of 37 Koppers-Becker ovens were put into operation by Public Service Electric and Gas Co., Camden, N. J. This installation is rated at 610 tons per day of coal carbonizing capacity. At the end of the year another new plant of 122 Koppers-Becker ovens was under construction by the Ford Motor Co., Dearborn, Mich. It has a carbonizing capacity of approximately 2,100 tons per day of coal. Two other plants also under construction at the end of the year will replace old ovens dismantled. These two installations are, 33 ovens being built by Columbia Steel Co., Provo, Utah, and 138 ovens for Carnegie-Illinois Steel Co., Gary, Ind. With the completion of these several works there will be approximately 6,000 tons per day of new capacity, including the replacements, out of a total rated capacity for the country of 172,000 tons of coal per day.



Coal-tar creosote oil
Chemical Division, Department of Commerce

The city gas industry during 1935 continued the improvement in activity which began during the preceding year. Approximately 80 million people are served by the manufactured and natural gas divisions of the industry. The manufactured-gas sales to these customers were approximately 225 billion cu.ft. for household cooking, refrigeration, and water heating, nearly 3 per cent less in volume than during 1934. Sales of manufactured gas for house heating, on the contrary, registered a gain of nearly 30 per cent; and sales of natural gas for all household uses recorded an upturn of 6 per cent. Even larger increases in sales for industrial and commercial purposes occurred, amounting to approximately 10 per cent in both manufactured and natural gas divisions.

Byproducts Obtained From Coke-Oven Operations in the United States in 1934[1]

[Exclusive of screenings or breeze]

Product	Production	Sales		
		Quantity	Value	
			Total	Average
Tar, gal.	408,710,314	273,763,739	$10,760,125	$0.039
Ammonia:				
Sulphate, lb.	785,444,684	777,115,791	7,501,160	.010
Ammonia liquor (NH_3 content), lb.	43,593,977	41,734,652	1,230,349	.029
			8,731,509	
Sulphate equivalent of all forms, lb.	959,820,592	944,054,399		
Gas:				
Used under boilers, etc., M cubic feet	[2]493,581,751	29,324,006	2,873,573	.098
Used in steel or affiliated plants, M cubic feet		119,716,459	11,001,864	.092
Distributed through city mains, M cubic feet		144,308,149	42,925,575	.297
Sold for industrial use, M cubic feet		16,222,743	2,457,827	.152
		309,571,357	59,258,839	.191
Light oil and derivatives:				
Crude light oil, gal.	[3]115,694,748	11,648,726	978,260	.084
Benzol, crude and refined, gal.	21,690,879	17,743,944	2,778,870	.157
Motor benzol, gal.	50,046,610	49,224,891	4,615,604	.094
Toluol, crude and refined, gal.	13,281,794	13,240,880	3,638,031	.275
Solvent naphtha, gal.	3,048,744	2,881,531	502,478	.174
Xylol, gal.	2,736,295	2,752,302	633,341	.230
Other light-oil products, gal.	3,765,817	1,350,270	70,945	.053
	[4]94,570,139	98,842,544	13,217,529	.134
Naphthalene, crude and refined, lb.	10,743,471	10,500,285	131,299	.013
Tar derivatives:				
Creosote oil, distillate as such, gal.	11,571,143	5,302,775	439,858	.083
Creosote oil in coal-tar solution, gal.	836,867	197,710	16,696	.084
Pitch of tar, net tons	97,898	4,937	31,478	6.376
Other tar derivatives			167,182	
Phenol, gal.	68,609	68,358	19,049	.279
Other products.[5]			92,264	
Value of all byproducts sold			[6]92,865,828	

[1]Includes products of tar distillation conducted by coke-oven operators under same corporate name, except, however, phenol and other tar acids produced at Clairton, Pa.
[2]Includes gas wasted and gas used for heating retorts.
[3]Refined on the premises to make the derived products shown, 108,219,464 gallons.
[4]Total gallons of derived products.
[5]Ammonia thiocyanate, carbolates, cyanogen, insecticides, pyridine oil, sodium prussiate sulphur, and vented vapors.
[6]Exclusive of the value of breeze production, which in 1934 amounted to $5,691,136.

Estimates of the Gas Industry for 1935

	1935	1934	Per Cent Change
Manufactured and Natural Gas			
Gas customers.	16,002,000	15,722,000	+1.8
Gas sales (MCF)	1,406,782,000	1,307,723,000	+7.6
Revenue from gas sales	$726,306,000	$702,614,000	+3.4
Manufactured Gas			
Gas customers.	9,973,000	9,874,000	+1.0
Gas sales (MCF)	357,182,000	347,453,000	+2.8
Revenue from gas sales	$372,971,000	$374,845,000	− .5
Natural Gas			
Gas customers.	6,029,000	5,848,000	+3.1
Gas sales (MCF)	1,049,600,000	960,270,000	+9.3
Revenue from gas sales	$353,335,000	$327,769,000	+7.8

Data from American Gas Association

TRENDS IN PRODUCTION OF COMPRESSED GASES

THE compressed gas industries experienced an eventful year during 1935 and one that witnessed many noteworthy accomplishments in each of its several branches. The refrigerant gases, for instance, found a wider field, particularly the fluorine derivatives which received so much public attention. Their characteristics give them a practical value. In spite of the popularity of those gases the other refrigerants found extended avenues of usefulness and the demand for them steadily increased.

The oxy-acetylene industry, as usual, set a rapid pace in the development of new uses and applications of its commodities. Through the researches of this industry the art of gas welding was greatly enhanced by new methods and processes.

In the carbon dioxide industry a steady gain in the consumption of its products was noted. About the same ratio of increase being maintained by the gas in both its solid and liquid form. The chlorine industry also reported an increase in the consumption of its products over that of the previous year.

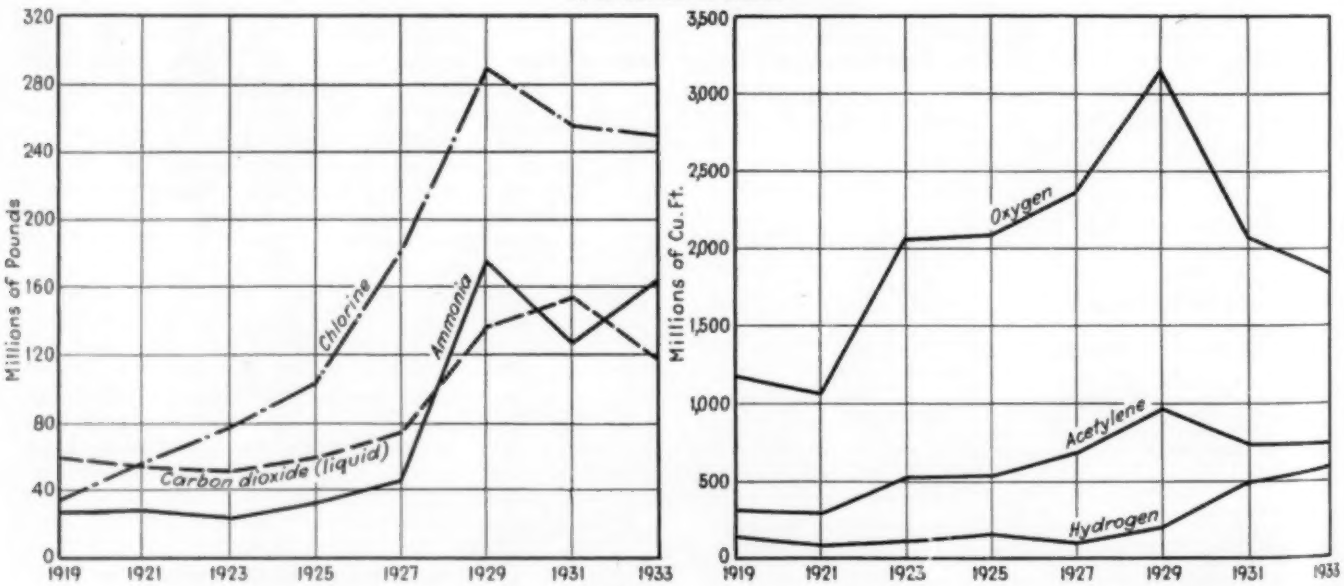
The medical gas industry observed some very significant changes during 1935. The use of medical oxygen for therapeutic processes consumed an increasing amount of that gas. The use of artificial atmospheres composed of carbon dioxide and oxygen, and also oxygen and helium found increases in practical and experimental use. The new anaesthetic gas, cyclopropane, is also reported to have developed additional demands for its use.

The liquefied petroleum gas industry, which has had a phenomenal growth during its relatively short existence, found 1935 an important year in its development. Propane for gasless homes is now available practically anywhere in the United States. Butane was shipped in larger quantities than ever before to enrich city gas supplies of low thermal value. This gas was also used in increased quantities as a fuel for motor vehicles and for combustion engines designed for railroad service.

Large volumes of the hydrogen that was produced in 1935 were not handled as compressed gases but found their way directly into hydrogenation processes. That part of the production which was shipped in cylinders exceeded that of the previous year. It may be noted that the production of this gas has steadily increased since 1927.

No specific estimates of production of the compressed gases is attempted here, but in general it may be said that these industries are able to report increases over the several preceding years. The Bureau of Census compiles statistics biennially which include production estimates of compressed gases. Their last report covered the year 1933. Statistics for 1935 have not yet been released.

Trends in Production of Gases "For Sale"
U. S. Bureau of Census



LEAD AND ZINC PIGMENTS

CONTINUED progress in the lead pigments in 1935 is evidenced by gains in the sales of all items covered by the preliminary survey of the U. S. Bureau of Mines. Sales of white lead, dry and in oil, were higher than at any time since 1931 and sales of red lead, orange mineral, and basic lead sulphate were the highest since 1930. Sales of litharge were the largest since 1929.

In 1934 sales of zinc oxide and leaded zinc oxide declined from those of the preceding year but in 1935 they joined in the general advance and made substantial gains over 1934. Zinc oxide sales were the largest since 1930; leaded zinc oxide sales have been exceeded in only two or three previous years. Lithopone sales last year were better than at any time since 1930. Preliminary data on zinc chloride and zinc sulphate indicate that sales of these salts increased slightly in 1935.

Lead and Zinc Pigments and Zinc Salts Sold by Domestic Manufacturers in the United States, 1934-35, in Short Tons

	1934	1935
Basic lead sulphate or sublimed lead:		
White	6,399	8,700
Blue	668	1,000
Red lead	26,743	28,500
Orange mineral	234	300
Litharge	68,733	81,100
White lead:		
Dry	22,569	26,900
In oil[1]	56,165	70,100
Zinc oxide	87,088	102,000
Leaded zinc oxide	20,506	29,900
Lithopone	145,565	160,000
Zinc chloride, 50° Baume	[2]19,614	20,500
Zinc sulphate	6,783	7,200

[1]Weight of white lead only.
[2]Revised figures.

WHERE COMPRESSED GASES ARE PRODUCED IN THE UNITED STATES

ALABAMA
Birmingham: Acetylene, carbon dioxide, hydrogen, oxygen
Fairfield: Oxygen
Mobile: Oxygen

ARIZONA
Phoenix: Acetylene, oxygen

ARKANSAS
Fort Smith: Oxygen, hydrogen

CALIFORNIA
Berkeley: Carbon dioxide
Los Angeles: Acetylene, carbon dioxide, solid carbon dioxide, hydrogen, oxygen, petroleum gases
Agnew: Carbon dioxide
Glendale: Medical oxygen, nitrous oxide, ethylene
Long Beach: Petroleum gases
Oakland: Carbon dioxide, ethylene, medical oxygen, nitrous oxide, oxygen
Pittsburg: Ammonia, chlorine, sulphur dioxide
Huntington Park: Acetylene, oxygen
Antelope: Solid carbon dioxide
San Francisco: Acetylene, ammonia, carbon dioxide, hydrogen, oxygen, petroleum gases
Sacramento: Oxygen
Vernon: Oxygen, hydrogen
West Berkeley: Acetylene
Mare Island (Navy Yard): Hydrogen, oxygen

COLORADO
Denver: Acetylene, carbon dioxide, oxygen
Manitou: Carbon dioxide
Pueblo: Oxygen
Thatcher: Helium

CONNECTICUT
New Haven: Hydrocarbon gas
Tariffville: Oxygen, hydrogen

DELAWARE
Wilmington: Carbon dioxide

FLORIDA
Jacksonville: Carbon dioxide, oxygen
Miami: Solid carbon dioxide
Tampa: Acetylene, oxygen

GEORGIA
Atlanta: Acetylene, carbon dioxide, hydrogen, oxygen
Savannah: Oxygen

ILLINOIS
Aurora: Oxygen, hydrogen
Blue Island: Acetylene
Chicago: Acetylene, ammonia, carbon dioxide, hydrogen, oxygen, hydrocarbon gases
East St. Louis: Carbon dioxide, chlorine
Granite City: Oxygen
Madison: Acetylene
Peoria: Acetylene, solid carbon dioxide, hydrogen, oxygen
Valley City: Solid carbon dioxide
Woods River: Solid carbon dioxide

INDIANA
Beech Grove: Acetylene, hydrogen, oxygen
East Chicago: Acetylene, oxygen, chlorine
Hammond: Acetylene
Indianapolis: Acetylene, carbon dioxide, hydrogen, oxygen
Logansport: Oxygen, hydrogen
Whiting: Hydrocarbon gases

IOWA
Bettendorf: Acetylene, oxygen
Davenport: Acetylene, oxygen
Des Moines: Acetylene

KANSAS
Dexter: Helium
El Dorado: Hydrocarbon gases
Kansas City: Acetylene
Wichita: Acetylene, oxygen

KENTUCKY
Louisville: Acetylene, carbon dioxide, oxygen

LOUISIANA
New Orleans: Acetylene, carbon dioxide, oxygen, hydrogen
Shreveport: Acetylene, oxygen

MAINE
Portland: Chlorine

MARYLAND
Baltimore: Acetylene, carbon dioxide, medical oxygen, nitrous oxide, ethylene, oxygen
Elkton: Acetylene

MASSACHUSETTS
Boston: Carbon dioxide, hydrogen, oxygen
Cambridge: Acetylene
Everett: Ammonia, carbon dioxide
East Deerfield: Acetylene
Indian Orchard: Acetylene
Pittsfield: Oxygen, hydrogen
West Quincy: Acetylene
Worcester: Oxygen
Charleston (U. S. Navy Yard): Oxygen, hydrogen

MICHIGAN
Detroit: Acetylene, oxygen, hydrogen, carbon dioxide, solid carbon dioxide, nitrous oxide, medical oxygen, ethylene
Flint: Oxygen
Grand Rapids: Acetylene, oxygen
Menominee: Chlorine
Midland: Ammonia, chlorine
Wyandotte: Ammonia, solid carbon dioxide, chlorine

MINNESOTA
Duluth: Acetylene, oxygen
Minneapolis: Acetylene, carbon dioxide, nitrous oxide, medical oxygen, ethylene, oxygen
St. Paul: Carbon dioxide, hydrocarbon gases
St. Louis Park: Acetylene

MISSOURI
Kansas: Acetylene, carbon dioxide, ethylene, medical oxygen, nitrous oxide, oxygen
St. Louis: Acetylene. ammonia, carbon dioxide, hydrogen, solid carbon dioxide, oxygen

MONTANA
Butte: Oxygen

NEBRASKA
Omaha: Acetylene, hydrocarbon gases, oxygen

NEW HAMPSHIRE
Berlin: Chlorine

NEW JERSEY
Bayonne: Oxygen, hydrogen
Bloomfield: Oxygen, hydrogen, medical oxygen, nitrous oxide, ethylene
Bound Brook: Acetylene, sulphur dioxide
Deep Water Point: Chlorine, solid carbon dioxide
Elizabeth: Acetylene, carbon dioxide, oxygen, solid carbon dioxide
Newark: Ammonia, oxygen, acetylene, carbon dioxide
Harrison: Acetylene, oxygen, hydrogen, medical oxygen, carbon dioxide
Perth Amboy: Ammonia, chlorine, methyl chloride
North Bergen: Acetylene, oxygen
East Rutherford: Hydrogen sulphide
Gloucester: Acetylene
Hoboken: Hydrogen, medical oxygen, nitrous oxide, ethylene
Jersey City: Oxygen, hydrogen

NEW YORK
New York: Carbon dioxide
Niagara Falls: Chlorine, oxygen, ammonia, methyl chloride, solid carbon dioxide
Port Ivory: Oxygen, hydrogen
Prince Bay: Nitrous oxide, medical oxygen
Syracuse: Chlorine, ammonia
Utica: Oxygen

NORTH CAROLINA
Charlotte: Oxygen, carbon dioxide

OHIO
Akron: Oxygen
Canton: Oxygen, hydrogen, acetylene, medical oxygen
Cincinnati: Acetylene, carbon dioxide, oxygen
Cleveland: Carbon dioxide, medical oxygen, ethylene, nitrous oxide, oxygen, hydrocarbon gases
Columbus: Acetylene, hydrogen, oxygen
Dayton: Oxygen
Lima: Oxygen
Niles: Oxygen
Painesville: Chlorine
Portsmouth: Oxygen
Stubenville: Oxygen
Toledo: Acetylene, oxygen
Warren: Acetylene, oxygen
Youngstown: Oxygen

OKLAHOMA
Bartlesville: Hydrocarbon gases
Oklahoma City: Acetylene, solid carbon dioxide, hydrogen, oxygen
Tulsa: Hydrocarbon gases, solid carbon dioxide, acetylene, oxygen, carbon dioxide

OREGON
Portland: Acetylene, carbon dioxide, oxygen

PENNSYLVANIA
Allentown: Acetylene, oxygen
Bethlehem: Oxygen
Bradford: Hydrocarbon gas
Bridgeport: Acetylene
Coatsville: Oxygen
Coraopolis: Oxygen, hydrogen
Chester: Oxygen
Davis Island: Oxygen, hydrogen, acetylene
Enola: Acetylene, oxygen
Erie: Oxygen, hydrogen
Harrisburg: Acetylene, oxygen
Milton: Oxygen
Johnstown: Oxygen
McKeesport: Acetylene
Oil City: Hydrocarbon gas
Neville Island: Acetylene
Philadelphia: Ammonia, carbon dioxide, solid carbon dioxide, oxygen, hydrogen, acetylene, nitrous oxide, medical oxygen
Pitcairn: Acetylene, oxygen, hydrogen
Pittsburgh: Acetylene, oxygen, hydrogen, hydrocarbon gas carbon dioxide
Reading: Oxygen
Sharon: Oxygen
Trafford: Oxygen
Verona: Oxygen, hydrogen
Kane: Hydrocarbon gas

RHODE ISLAND
Providence: Chlorine, hydrogen

TENNESSEE
Ashville: Oxygen
Chattanooga: Acetylene, hydrogen, oxygen
Knoxville: Acetylene, hydrogen, oxygen
Nashville: Acetylene, hydrogen, oxygen
Memphis: Carbon dioxide, acetylene, oxygen

TEXAS
Beaumont: Oxygen
Dallas: Carbon dioxide, acetylene, hydrocarbon gas, oxygen
El Paso: Acetylene, oxygen
Amarillo: Helium, oxygen
Fort Worth: Acetylene, carbon dioxide, oxygen, helium
Houston: Acetylene, solid carbon dioxide, oxygen
San Antonio: Acetylene, carbon dioxide, oxygen
Wichita Falls: Acetylene, oxygen

UTAH
Salt Lake City: Acetylene, hydrogen, oxygen

VIRGINIA
Hopewell: Ammonia
Norfolk: Oxygen, carbon dioxide, sulphur dioxide, methyl chloride
Portsmouth: Oxygen, hydrogen
Roanoke: Oxygen
Richmond: Acetylene, oxygen
Saltville: Ammonia, chlorine, solid carbon dioxide
South Washington: Acetylene, hydrogen, oxygen, carbon dioxide
Newport News: Acetylene, oxygen

WASHINGTON
Seattle: Acetylene, carbon dioxide, ammonia, oxygen
Spokane: Acetylene, oxygen
Tacoma: chlorine
Bremerton (U. S. Navy Yard): Acetylene, hydrogen, oxygen

WEST VIRGINIA
Belle: Ammonia, chlorine
Clendenin: Ethylene, hydrocarbon gases
Huntington: Acetylene
St. Albans: Ammonia, chlorine, methyl chloride
So. Charleston: Acetylene, oxygen, chlorine
Wheeling: Oxygen

WISCONSIN
Carrollville: Oxygen, hydrogen
Kenosha: Acetylene, hydrogen
Marinette: Sulphur dioxide, methyl chloride
Milwaukee: Acetylene, oxygen, hydrogen
Sheboygan: Oxygen
West Allis: Acetylene

WYOMING
Acetylene, oxygen

LARGER CONSUMPTION OF VEGETABLE OILS

WITH LAST year's cotton acreage restricted by government regulations, the supply of seed for crushing purposes was correspondingly cut down and production of crude and refined cottonseed suffered accordingly. The smaller oil supply thus made available became an important price factor and values in domestic markets rose to a point where, for the first time in the history of the trade, imported cottonseed oil became a competitor of importance.

Despite the increase in imports, prices for cottonseed oil maintained a relatively high average for the year and based on the law of supply and demand a strong market may be looked for over a considerable period with next season's cotton acreage determining how long the high-priced era will continue.

On August 1—the beginning of the new oil year—there was a carryover of about 1,200,000 bbl. New production was figured at 2,575,000 bbl. Apparent consumption for the five months ended December 31 was 1,582,000 bbl., leaving a total visible supply of 2,193,000 bbl. for the next seven months of the oil year. Average monthly consumption of 300,000 bbl. would exhaust this supply before the next new crop oil will become available. This means that either consuming demand must decline or imported oil must be brought into this country to prevent a shortage. In any event the statistical position favors a strong market for the future, especially when it is taken into consideration that the above figures for August-December consumption in 1935 refer only to domestic oil without adding in the amounts of foreign oil also consumed in that period.

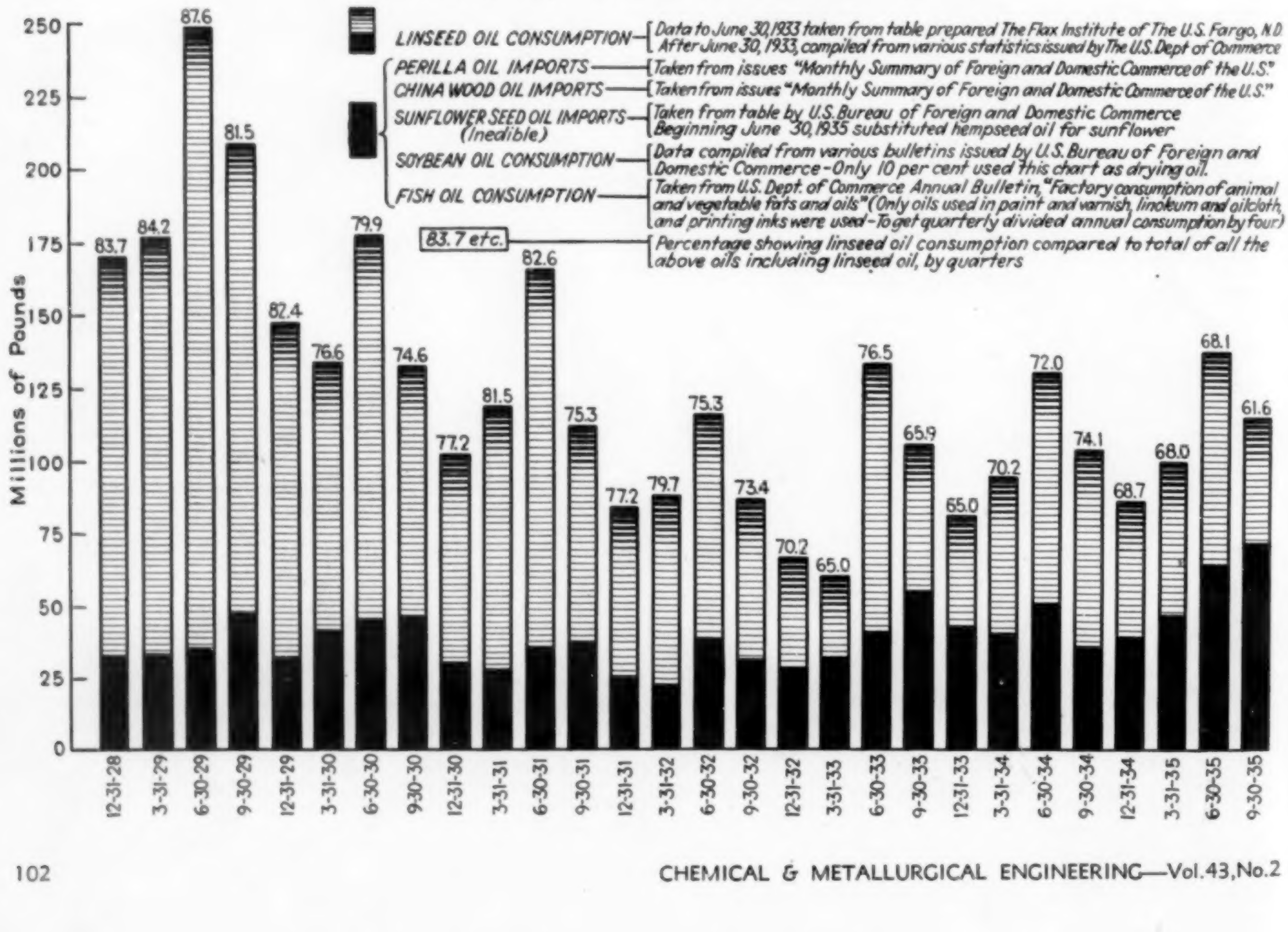
The report of the Department of Agriculture issued last November estimated the domestic yield of flaxseed for 1935 at 14,213,000 bu. The revised figure for 1934 showing the amount harvested was 5,213,000 bu. Hence last year's crop showed a good gain over that of the preceding year but still falls short of domestic crushing requirements. The Argentine crop for 1935, in the second official estimate, was placed at 6,570,000 acres with 8,098,000 acres for 1934. Argentine surplus from the present yield will probably run around 50,000,000 bu. This is lower than in several years and the world seed situation points to firm markets.

Domestic production of linseed oil was increased in the final quarter of last year and amounted to 156,568,704 lb. This brought the calendar year production to 502,004,325 lb., which compares with 370,768,585 lb. in 1934 and 405,948,180 lb. for 1933. Stocks reported by crushers amounted to 112,405,721 lb. on Dec. 31, compared with 78,198,651 lb. on Dec. 31, 1934.

China wood oil was featured during the year by a return to the high price levels which ruled in the immediate post-war years. Exchange, difficulty in getting stocks from interior points in China, and smaller supplies generally, brought about the rise. The new tung nut crop in China is reported to be of normal size and arrivals of fair-sized stocks at collection points in November indicated that the crop was moving earlier than had been expected.

In a survey of developments in producing domestic tung oil, the Department of Commerce stated that total consumption of this oil in the United States in 1933 was 105,000,000 lb. This increased to 115,000,000 lb. in 1934. The United States takes about 7.5 per cent of China's exports and the paint and varnish industry accounts for about 75 per cent of all the tung oil consumed.

Comparison of Consumption of Linseed Oil With Competing Oils



There is no definite record as to the extent to which the tung tree has been planted in the United States, but it is estimated that as many as 60,000 acres have been set to tung in various parts of Florida, Georgia, Alabama, Mississippi, Louisiana and Texas. The earliest developments were in Florida and the movement is progressing in Texas, but the greatest acreage is in Mississippi.

Three years ago two full tank cars of tung oil were shipped from Gainesville, Fla. Because of adverse weather conditions no oil was produced or shipped from the South the following year. The last season, which closed several months ago, brought forth approximately 400,000 lb. of oil produced in various parts of the Gulf states and milled in the two existing plants at Gainesville, Fla., and Bogalusa, La. Exceptional frost conditions were experienced last winter and as a result, the production of the current growing season will not be more than 10 per cent of what it was the past season. The groves of the South had a splendid growing season last summer and with favorable climatic conditions this winter and in the spring when the trees are in blossom, indications are there will be an excellent yield of nuts next year and a worthwhile output of oil.

American plantations produce a quality of oil that is superior to Chinese oil physically and chemically. American produced oil that came on the market from last season's production, commanded a ready premium over the Chinese oil of from 2 to 4c. a lb. and because of the superior quality, will doubtless continue to command a premium.

Soya bean oil came into greater prominence during the year because of increased domestic production. A government announcement said that in less than 30 years the domestic soya bean acreage had increased from 50,000 acres to 5,000,000 acres—in fact the 1935 acreage is reported at 5,463,000 not including what was sown with corn and other crops for forage. The soya bean harvest in 1934 was 17,762,000 bu. Only about 20 per cent of the total crop is harvested for the oilseeds. In the first half of this year production of crude soya bean oil was 42,260,967 lb. compared with 14,692,499 lb. in 1934.

Factories in the United States used 20,907,000 lb. of soya bean oil in 1934, about half—10,451,000 lb.—went into the making of paint and varnish. The remainder was used as follows: compounds and vegetable shortenings, 2,735,000 lb.; other edible products, 533,000 lb.; soap, 1,354,000 lb.; linoleum and oilcloth, 2,843,000 lb.; printing inks, 59,000 lb.; miscellaneous products, 2,109,000 lb.

Imposition of processing taxes, higher primary markets, and enlarged consuming demand were factors in holding prices for vegetable oils at high figures throughout the year. The weighted index number of *Chem. & Met.* was 86.64 in January, 1935, and in December it had risen to 93.05.

END OF MARKETING AGREEMENT UNSETTLED NAVAL STORES

NAVAL STORES entered last year with a marketing agreement acting as a stabilizer of values. This condition held true for the first quarter of the year but with larger receipts from the new crop from April forward, the price trend turned downward.

In April the marketing allotment for the 1935 season for the wood naval stores branch of the industry was announced as 95,000 bbl. of turpentine. This was divided on a basis of 76,286 bbl. for processors using the steam distillation method, 12,063 bbl. for those using the sulphate process and 6,651 bbl. for those using the destructive distillation method. Producers by steam distillation were alloted as much rosin as they produce in connection with their turpentine quota.

On August 1 a notice was issued from Washington to the effect that pending amendments to the AAA, government loans to producers of gum rosin and gum turpentine had been suspended. An order also was issued by the Acting Secretary of Agriculture suspending the licenses for agents, commission merchants, distributors, and factors of gum rosin and turpentine. The suspension also applied to the license for gum rosin and turpentine processors which related to the use of marketing tags.

Following these announcements, prices for naval stores broke sharply and reached the low level of the year during that month.

In December a conference was held between representatives of the industry and officials of AAA with a view of developing a plan for a controlled production program. The industry proposed that a program be conducted and financed under provisions of Section 32 of Public No. 320, approved August, 1935, but it was pointed out that this would not meet the requirements of the measure which relates to increasing domestic consumption and exports.

In September the Wood Naval Stores Export Association filed papers under the Export Trade Act (Webb-Pomerene law) with the Federal Trade Commission for exporting FF wood rosin and pine oil. Leading producers were named as members of this association.

Some modifications of rosin color standards were proposed in the year and studies along that line were made with the aid of government departments. It was rather generally conceded that better color spacing may be feasible but it is desired to try out the proposed changes in a tentative form before taking any decided step. When changes are made it is probable that the number of color standards will not be significantly reduced especially in the light-colored end of the series.

The naval stores industry of France —which ranks next to that of the United States—had a poor year with both home consumption and export trade on a declining scale. To stimulate export business, the French government appropriated $300,000 to pay export bounties on shipments made in the last half of the year. The bounties were on a basis of $5 a metric quintal for turpentine and 67c. for rosin. Prizes also were offered for the development of new uses for these products and experiments with rosin for surfacing for roadways was reported to have given considerable promise. Production of naval stores in France in 1935 was about the same as in the preceding year.

Exports of naval stores in 1935 reached a total valuation in round figures of $16,489,000 as compared with $14,489,000 for the preceding year.

Receipts of Gum Rosin and Turpentine at Three Southern Ports

	Gum Rosin		Gum Turpentine	
	1935 500-lb. bbl.	1934 500-lb. bbl.	1935 50-gal. bbl.	1934 50-gal. bbl.
Jan.....	27,406	39,219	4,300	4,985
Feb.....	19,525	32,640	2,235	2,639
March..	28,397	59,443	4,761	8,721
April....	69,290	69,496	18,410	17,315
May....	97,354	97,905	24,366	24,658
June....	110,998	102,417	32,128	27,614
July....	124,401	116,019	35,293	31,148
Aug....	120,950	109,234	31,136	32,473
Sept....	88,784	89,289	18,798	26,856
Oct.....	93,917	92,482	20,646	25,161
Nov....	95,860	100,257	20,101	22,999
Dec.....	72,903	122,173	11,648	22,834
	949,785	1,030,574	223,822	247,403

Production of Wood Rosin and Turpentine

	Wood Rosin 500-lb. bbl.		Wood Turpentine 50-gal. bbl.	
	1935	1934	1935	1934
Jan.....	44,489	46,850	7,075	7,970
Feb.....	43,252	46,016	6,138	7,982
Mar.....	43,294	43,753	6,316	7,279
April....	46,028	45,454	7,049	7,729
May....	47,867	43,243	7,004	7,050
June....	47,293	38,554	6,787	6,393
July....	47,651	37,037	7,261	5,547
Aug....	48,063	38,537	7,324	5,904
Sept....	47,388	43,095	7,550	6,798
Oct.....	43,719	39,785	6,910	6,288
Nov....	47,214	41,884	7,474	6,548
Dec.....	43,894	41,016	7,355	6,290
Totals	550,152	505,224	84,243	81,688

FOREIGN TRADE IN CHEMICALS MADE PROGRESS LAST YEAR

FOREIGN DEMAND for American chemical products continued strong in 1935, gaining substantially over the preceding year, and on a value basis was almost 30 per cent heavier than in 1933, according to figures compiled by the Department of Commerce. Moreover the export trend strengthened as the year advanced, reaching very high levels in the last half, particularly in October and November, with nearly every major export item sharing in the gain.

An encouraging feature of the 1935 demand, aside from the general increase, was the notable expansion of markets for high grade specialties, such as ready mixed paints, toilet requisites, household insecticides, liquefied gases for heating and refrigerating, and of other typically American products. A number of these specialty items were shipped to practically every country of the world.

The total value of exports of chemicals and allied products reached $136,677,000 in 1935, or about 65 per cent of the value of 1929 shipments, and compares with $125,777,000 during the preceding year, and $106,731,000 in 1933, preliminary statistics show.

Industrial chemicals, which include such products as alcohols, acids and sodium compounds, made the best export showing in the chemical and related product field during the past three years, statistics show. Exports of such products aggregated $23,627,300 in value in 1935, compared with $21,683,500 in the preceding year, and $16,801,700 in 1933. The 40 per cent increase in this group over the 1933 level was due very largely to heavier shipments of the miscellaneous small items included in the total.

Shipments of naval stores, gums and resins, the principal items of which are rosin and turpentine, aggregated $16,489,000 during the year, compared with $14,489,200 in 1934. Shipments of both turpentine and rosin increased in value, despite intense competition in world markets from European naval stores producers.

The export demand for paints, pigments, and varnishes was especially good during the year, the grand total of such shipments reaching $16,345,000, preliminary statistics show. In the preceding year export shipments of such products were valued at $14,214,000, and in 1933 the value was $11,834,000. In this group shipments of ready mixed paints, varnishes and lacquers have almost doubled, both in quantity and value during the past three years, and as the year closed shipments were going forward regularly to every point of the globe.

Our rapidly growing export trade in fertilizers is noteworthy. Formerly almost entirely dependent upon foreign countries for many materials necessary for the manufacture of a balanced soil food, particularly nitrates and potash, the United States has now become an important exporter of such products. Almost 1½ million tons of fertilizer materials, valued at $14,809,000, were exported in 1935, compared with 1 and ⅓ million tons valued at $12,543,000 during the preceding year, and a little over one million tons valued at $8,269,000 in 1933. Approximately one-half of the value of shipments in 1935 was accounted for by potassic and nitrogenous fertilizers and fertilizer materials.

Reflecting the extent to which exports of chemicals were affected by the Italo-Ethiopian controversy, official figures give such exports to Italy as reaching a value of $1,905,873 in 1935 and $1,738,978 in 1934. Exports to Italian Africa were valued at $324,987 in 1935 and $5,303 in 1934. Chemical exports to Ethiopia in 1935 were valued at $545 as against $237 in 1934.

In the coal-tar group, exports of benzol were prominent, reaching a total of 14,665,639 gal. as against 9,692,010 gal. in 1934. Creosote oil also in better demand from foreign buyers and the amount shipped out increased from 194,518 gal. in 1934 to 349,220 gal. in 1935. On the other hand imports of creosote oil continued the upward trend of recent years. Imports in 1935 were 34,513,486 gal. compared with 31,773,930 gal. in 1934.

Foreign trade in coal-tar dyes, stains, and colors also was of an expanding nature last year, reaching a volume of 19,630,924 lb. compared with 17,942,203 lb. for the preceding year. Imports of dyes also gained but the total is far below that exported. Imports of dyes in 1935 were 4,606,270 lb. and in 1934, 4,240,798 lb.

In the industrial chemical group, boric acid showed some expansion in foreign trade, with losses reported for the different alcohols. Aluminum sulphate exports advanced to 66,181,582 lb. from the 1934 total of 61,429,272 lb. with Canada taking the major part.

Potassium compounds, not including fertilizer materials, made an excellent showing, with shipments of 7,281,110 lb. where the 1934 volume had reached only 4,241,537 lb.

Sodium compounds have been moving up in export trade in recent years and 1935 saw a continuance of this condition. Total exports for the year were 522,861,461 lb. as against 483,110,626 lb. for the preceding year. Silicate of soda offered an exception to the general rule with a fall in shipments to 15,757,990 lb. against 21,304,496 lb. in 1934 and 43,985,017 lb. in 1933. Canada has been the largest outside buyer of silicate and the loss in exports is almost entirely due to increased production of silicate in Canada. Exports of borax rose to 228,894,860 lb. or a gain of more than 10 per cent over shipments made in 1934. Foreign markets increased their call for soda ash by more than 30 per cent which swelled the 1935 total to 87,050,383 lb. Caustic soda shipments rose from 131,651,201 lb. in 1934 to 139,138,335 lb. in 1935.

WESTERN PROCESS INDUSTRIES LOOK FOR NEW GROWTH

By Paul D. V. Manning
Pacific Coast Editor,
Chem. & Met.

IN ULTIMATE ANALYSIS the life cycle of a process industry depends for its start upon natural resources and the need for its products. The Far West reveals many examples of such development. Natural resources, varied in kind and quantity, are mainly responsible for the growth of many of our process industries. Certain of these resources have given the West almost exclusive control of the production of a few commodities—borax, potash, diatomaceous earth, for example. In the case of others, the relatively small local population and the long distances from major consuming centers have restricted these industries mainly to western interest.

Without the combination of very cheap power and cheap fuel, many western resources would probably have remained undeveloped except for local consumption. While export business was flourishing just prior to 1930, some

new plants were established, but with the loss of foreign markets, difficulties have been encountered in some industries. Fortunately, however, local markets are growing and this means a larger volume of business. It is becoming increasingly difficult for eastern-made goods to compete in western markets with the local products. With cheap power, western products should move east and exports again become a possible direction for expansion.

This article is intended to indicate briefly the status of the process industries in the West, and, in a limited way, to point out what seems to be opportunities for expansion and establishment of new industries. One table summarizes the more important process industries of the Pacific Coast states—California, Oregon and Washington. In almost all cases, the industries shown derive their raw materials from the western states.

It is perhaps unfortunate that no very good coal has ever been found in the Far West in any quantity. This makes it necessary to depend upon Utah and shipping costs are correspondingly high. Coke from petroleum, suitable for metallurgical work, is a possibility which is engaging increasing attention.

With the coming of cheap electric power in Oregon and Washington, synthetic nitrogenous and phosphate fertilizers are worthy of consideration. These states are highly developed agriculturally and low-priced fertilizers should find good local markets.

Manufactured gas includes that made from oil as well as from coal. There are very few plants for the latter, however, and many of the oil-gas plants are not in continuous operation since the extension of pipelines has brought natural gas to many communities. The oil-gas plants, however, have been kept in standby condition in most cases. Natural gas as a chemical raw material is worthy of further consideration by process industries. It is already so used by several large chemical plants, notably in the synthesis of ammonia and certain solvents.

Two industries, wood pulp and petroleum, seem to offer good opportunities for research and development in the use of their wastes and byproducts. In the manufacture of pulp, only the cellulose is now utilized on any large scale. With the installation in the oil industry of polymerization plants and solvent extraction units for refining lubricating oils, the probable use of more chemical byproducts from petroleum is definitely increased.

Considering raw materials and markets, other process industries which seem to offer most opportunity for expansion on the Pacific Coast are: glass in Oregon and Washington, essential oils in all three states, paints and varnishes in Washington, rayon, activated carbon, decolorizing carbon and tanning materials.

Existing chemical industries are shown in the table. Although there is ample capacity in the United States for manufacturing many of these products, the possibility of cheap electric power may so lower the cost of manufacture as to make such products available in fields in which they are not marketed at present. The use of synthetic ammonia in fertilizer is increasing the market for anhydrous ammonia. The manufacture of chemicals by electrolysis and from wood wastes and paper mill wastes is worthy of close study. Processes in use for the production of magnesium compounds from sea water, coupled with cheap electric power, also make the production of metallic magnesium an interesting possibility.

Status and Prospects of Principal Western Chemical Industries

Commodity	No. of Present Plants Calif.	Ore.	Wash.	Possible Expansion Worth Consideration Calif.	Ore.	Wash.	Raw Materials Locally Available	Raw Materials Some Must Be Shipped In
Acetic Acid	1	..	..	X	..	X	X	..
Acetone	..	..	..	..	X	X	X	..
Activated Carbon	..	..	..	X	X	X	X	..
Agar Agar	1	..	..	..	..	..	X	..
Alginic Acid	1	..	..	..	..	..	X	..
Al. Chloride	..	..	..	X	..	X	X	..
Al. Sulphate	2	..	..	..	..	..	..	X
Anhyd. Ammonia	2	..	2	X	X	X	X	..
Amyl Acetate	..	..	..	..	X	X	X	..
Amyl Alcohol	2	..	..	..	..	..	X	..
Arsenate of lead	3	..	1	..	..	..	X	X
Arsenic, White	2	..	1	..	..	..	X	X
Barium Carb	1	..	..	..	..	..	X	..
Barium Sulphate	1	..	..	..	..	..	X	..
Basic Lead Carb	1	..	..	..	..	..	X	..
Benzol	1	..	1	..	..	..	X	..
Borax	6	..	..	..	..	..	X	..
Bromine	2	..	..	..	..	..	X	..
Butyl Acetate	1	..	..	..	..	..	X	..
Calcium Arsenate	2	..	..	..	..	..	X	..
Calcium Carbide	..	..	..	X	X	X	X	..
Calcium Chloride	3	..	..	..	..	..	X	..
Calcium Hypochlorite	1	..	..	..	..	..	X	..
Carbon Bisulphide	1	..	..	..	..	..	X	..
Caustic Soda	2	..	2	..	..	..	X	..
Compressed Gases	24	4	8	..	..	..	X	..
Copper Sulphate	4	..	..	..	..	..	X	..
Cream of Tartar	1	..	..	..	..	..	X	..
Ethyl Acetate	2	..	..	..	..	..	X	..
Ethyl Alcohol	5	1	..	..	..	..	X	X
Glaubers Salts	1	..	..	..	..	X	X	..
Hydrogen Perox	1	..	..	..	..	..	X	..
Hydrochloric Acid	3	..	1	..	..	..	X	..
Litharge	2	..	..	..	..	..	X	X
Magnesium Sulph	1	..	..	..	..	..	X	..
Magnesium Comp	2	..	..	..	..	..	X	..
Magnesium Metal	..	..	..	X	X	X	X	..
Mercury	12	2	2	..	..	..	X	..
Iodine	3	..	..	..	..	..	X	..
Iron Sulphate	2	..	..	..	..	..	X	..
Naphthalene	..	1	..	..	..	..	..	X
Niter Cake	1	..	1	..	..	..	X	X
Nitric Acid	3	..	..	..	..	..	X	X
Potassium Chlor	1	..	..	..	..	..	X	..
Pyrites	2	..	..	..	..	..	X	X
Red Lead	2	..	..	..	..	..	X	X
Salt Cake	2	..	..	..	..	..	X	X
Salt	11	..	..	..	..	..	X	..
Soda Ash	4	..	..	..	X	X	X	..
Sodium Phosphates	1	..	..	..	..	..	X	X
Sodium Silicate	3	..	..	..	X	X	X	X
Sodium Sulphide	2	..	..	..	..	..	X	..
Sulphur	1	1	..	..	..	..	X	..
Sulphuric Acid	10	..	1	..	..	..	X	..
Tin Chloride	1	..	..	..	..	..	X	X
Wood Chemicals	4	..	3	..	..	..	X	..
Xanthates	1	..	..	..	..	..	X	..
Zinc Dust	2	..	..	..	..	..	X	X

Status and Prospects of Western Process Industries

Art Leather	..	..	..	X	X	X	X	..
Bone Black, Carbon Black	2	..	..	..	..	..	X	..
Beet Sugar	5	..	..	..	..	..	X	..
Byprod. Coke	..	1	1	X	..	..	X	X
Bluing	1	..	1	..	..	..	X	X
Candles	1	..	..	..	..	..	X	..
Cement	12	3	6	..	..	..	X	..
Ceramics, Brick, Clay	114	18	25	..	..	X	X	X
Cane Sug. Ref	2	..	..	..	..	..	X	X
Cottonseed Oil & Cake	8	..	..	..	..	..	X	..
Drugs, Medicines Cosmetics	194	12	25	..	..	..	..	X
Explosives & Fireworks	8	..	6	..	..	..	..	X
Fertilizers	21	..	3	..	X	X	X	X
Glass	16	..	..	..	X	X	X	..
Gelatin, Glue Adhesives	14	..	2	..	X	..	X	..
Graphite	1	..	..	..	..	..	X	..
Leather, Tanning & Finish	10	5	2	..	..	..	X	..
Lime	7	2	4	..	..	..	X	..
Linoleum	1	2	..	..	..	..	X	X
Manufactured Gas	38	10	10	..	..	..	X	X
Matches	1	..	1	..	..	..	X	X
Minerals and Earths	9	..	1	..	..	..	X	..
Oil & Cake Linseed	..	2	..	..	..	..	X	..
Oils, Essential	2	..	1	X	X	X	X	..
Oils, Veg. & Fish	14	1	1	..	..	..	X	X
Paints & Varn	82	12	..	..	..	X	..	X
Paper Pulp	..	8	15	..	..	..	X	..
Petroleum Ref	54	..	..	..	..	..	X	..
Polishing and Clean. Prep	34	3	2	..	..	..	X	X
Printing Ink	6	1	..	..	..	..	X	X
Rayon	..	..	..	X	X	X	X	..
Rubber Goods except Tires	28	5	4	..	..	..	X	X
Rubber Tires	7	..	..	..	..	..	X	X
Soap	33	3	4	..	..	..	X	..
Tanning Mater	1	..	..	..	X	X	X	..
Wood Preserv	10	5	12	..	..	..	X	X
Writing Ink	..	..	1	..	..	..	X	X

NEWS FROM WASHINGTON

Washington News Bureau
McGraw-Hill Publishing Co.
Paul Wooton, Chief

CONFUSION of unprecedented magnitude surrounds the national plans for legislation and budget making. Estimates of deficiencies from now to July 1, 1937, range from \$6 billion to \$9 billion. The public debt certainly will be \$36.5 billion, and may be close to \$40 billion by the end of the next fiscal year. Business men will take no comfort in those rumored big bankers who are reported to have talked glibly to the President of a safe debt of \$70 billion.

New Business Rules

Business is governed by politics today. Those who are selected in the national elections later this year will find it necessary to write the rules by which business will be governed for a generation to come. No longer need a business man apologize for partisan consideration of these questions. They will affect him, and his company's balance sheet, whether he wishes or not.

The forecast that legislation in this session of Congress would be limited, and that the session would be short, is now clearly disproven. Regardless of further Supreme Court decisions, Congress has enough troublesome legislation before it to stay in session until time for the two national nominating conventions of June.

New Taxes

The President has promised to send a second budget message and proposals for new taxation to the Congress "about a month before adjournment." But nobody believes that a fundamental tax controversy will wait that long, nor that this session of Congress will settle the many controversial aspects which affect business enterprises within a four-week period. Some political forecasters are even anticipating that Congress may have to return in July, after the nominating conventions are over, to finish up its job of appropriating and tax levying.

It is futile at this early stage to be very precise in estimates as to the magnitude of new taxes or in guessing as to what industries will have to bear them. Apparently, however, it is safe to assume that a much broader group of industries will be burdened with excise taxes than bore the AAA processing tax burdens. Chemical process industries, therefore, must give close attention. Merely as a guess it is suggested here that taxes of the order of three-quarters of a billion dollars per year are likely to be levied this session, despite the intense political desire to avoid that complication before election.

The proposal of Representative Dockweiler to eliminate processing tax on coconut oil (H.R. 8000) has little chance of enactment. The "soap lobby" undertaking to push it, is probably not sufficiently potent to get consideration under present confused conditions. More important to the industrial fat-using industries is the Federal District Court decision in Iowa that the three-cent processing tax is unconstitutional because the funds are transferred to the Philippine Treasury. Ultimate review of that decision may reopen the controversy over Federal tax burdens on coconut oil. If those taxes are eliminated, new ones are surely to be pressed, probably successfully, by farm leaders.

International Troubles

A few more trade agreements are expected. Only the one with Spain gives promise of having real chemical interest. Negotiations with France, Britain, and other more important industrial nations are not expected to produce any downward tariff adjustment, because such dealings are too complicated to be practical of completion through the present State Department machinery.

Neutrality questions will be less influenced by the Senate munitions inquiry, headed by Senator Nye, than was expected. He and Senator Clark, airing their personal grudges against Woodrow Wilson, probably ruined their opportunity for leadership in these fields. The House bill defining the authority of the President in control of shipments to belligerents is being completed this month, and will probably become the basis of final legislation, after extensive debate and some revision in the Senate.

Explosives

Complete revision of the fundamental requirements defining permissibility of explosives for use in mining has been undertaken by the Bureau of Mines. Prof. Wilbert J. Huff, who has for twelve years headed the Department of Gas Engineering at Johns Hopkins University, has already assumed the post of chief explosives chemist of the Bureau. During the balance of the college year he continues his work as professor, but is devoting part time to the explosives investigation with headquarters in Washington.

Anti-Trust Moves

By a consent decree under the anti-trust law, the Federal District Court at Wilmington, Del., late in January virtually ensured new natural-gas pipeline building. The decree governing activities of Columbia Gas & Electric Corp., provides that this enterprise shall no longer interfere with the extension of the transmission lines of Panhandle Eastern Pipeline Co. which were headed for Indianapolis and Detroit. Delay in construction resulted, according to the decree, from indirect influence by Columbia through purchase of the other company's stock.

As a result of the decree, extensive new areas will be added to that served by natural gas from the Panhandle of Texas. About 300 miles of line will be built into Indianapolis and Detroit from the temporary terminus near Terre Haute, Indiana. Thus the industries of new territory may expect large supplies of high heating-value gas that should cost less than manufactured gas hitherto supplied.

This decision inspired Attorney General Cummings to comment that "these suits are interesting, especially in these days when some people seem to think that the anti-trust laws have been suspended." Thus what he calls the biggest case suggested by the Federal Trade Commission report becomes also an indicator of other prosecutions planned; "but not as any campaign," in the language of the Attorney General.

Federal Trade Commission, by numerous recent orders to cease and desist, and by investigative effort, continues to press from its point of view against industrial operations having a monopolistic trend. The fertilizer industry seeking a complete voluntary code of trade practices has requested open-price filing, under the Federal Trade Commission procedure. This request is the apparent cause of long delay in the announcement of voluntary code for that industry. But leaders of fertilizer thinking still were expecting F.T.C. approval early in February.

Even the Supreme Court takes a hand in these matters of price as a factor in monopoly, by a recent decision governing a petition of the Armand Co. By refusing to review this case the court of last resort virtually approved the Circuit Court opinion which was intended to prevent the fixing of resale prices by agreement between producer and marketer.

Chandler Medal Award To Prof. W. F. Giauque

AWARD of the 1935 Chandler Medal of Columbia University to Prof. William Francis Giauque of the University of California for his achievements in thermochemistry is announced by the University Trustees.

Prof. Giauque's announcement, made in 1929 in collaboration with Prof. H. L. Johnson of Ohio State University, that three kinds of oxygen existed instead of one kind, each variety, or isotope, having a different weight, stimulated worldwide research on all of the lighter elements, including hydrogen, nitrogen, and carbon, and led ultimately to the identification of a new isotope of hydrogen—deuterium, component of "heavy water"—by Prof. Harold C. Urey of Columbia University, it is pointed out.

C. O. North Killed in Autoclave Explosion

C. O. NORTH, a founder of the Rubber Service Laboratories and more recently an independent chemical manufacturer, was killed in his plant at Nitro, W. Va., on Feb. 6, when a high-pressure autoclave exploded during experimental work.

Dow Chemical Wins Oil Well Patent Suit

THROUGH a decision made by the U. S. Circuit Court of Appeals at Denver on Jan. 10 the validity of the patent for improving the flow of oil wells was upheld. The patent in question is held by the Dow Chemical Co., whose subsidiary, Dowell, Inc., has, for a long time, been employing the process covered by the patent in all the important oil-producing fields. The court decision reverses an Oklahoma District Court decision given early last year in an action brought by Dow Chemical Co. against the Williams Bros. Well Treating Corp., Tulsa, Okla. The present decision granted the request of the Dow Chemical Co. for an injunction and for an accounting of damages.

Dr. Norman A. Shepard Joins Cyanamid

ANNOUNCEMENT has been made to the effect that Dr. Norman A. Shepard has been appointed director of technical service for the American Cyanamid Co., the American Cyanamid & Chemical Corp., and other companies in the Cyanamid group where cooperation in this field is required. He will be responsible for directing the technical service laboratories located in Stamford, Conn., the expansion of the sales service laboratories to meet present and increasing need and the co-ordination of the technical and sales service work in all of the several divisions of the above named companies.

Dr. Shepard is a graduate of Yale University (Ph.D. 1913), was Assistant Professor of Chemistry at Yale University from 1917 to 1919 and has been director of the research laboratories of the Firestone Tire and Rubber Co. from 1919 to date. He will have his headquarters at the Stamford laboratory.

New Pulp Mill Planned For Houston

PLANS for a new pulp mill have been drawn by the Champion Paper and Fibre Co. According to reports from the South the new plant will be located about ten miles east of Houston, Texas, on the south side of the Houston ship channel. It is reported that an option has been taken on the J. S. Cullinan property which comprises 160 acres and which has a frontage of about 2,500 ft. on the ship channel. Options also are said to have been taken on a large tract of wooded property from which the company will derive its supply of pine wood for conversion into pulp, and on a 16-acre tract at Pierce Junction which contains a salt deposit.

Unofficial advices credit the building program as representing an expenditure of $585,000 on the plant, $200,000 for a water supply system, $300,000 for an electrolytic unit, and $2,000,000 for machinery and equipment.

Financing plans call for the issuance of 25,000 shares of 6 per cent cumulative preferred stock and 75,000 shares additional of common stock.

S. B. Colgate Heads Soap Association

AT THE annual meeting of the Association of American Soap and Glycerin Producers, held at the Hotel Biltmore, New York, Jan. 30, S. Bayard Colgate, president of Colgate-Palmolive-Peet Co. was elected president. Other officers elected were: vice-president for the East, F. A. Coupway, president of Lever Brothers, Cambridge, Mass.; vice-president for the Western States, F. H. Merrill, president of the Los Angeles Soap Co., Los Angeles; secretary, W. C. Wollen, president of the Olive Oil Soap Co., Paterson, N. J., and treasurer, N. S. Dahl, of the John P. Stanley Co., New York.

TAPPI Will Discuss Specifications

AN innovation at the annual meeting of the Technical Association of the Pulp and Paper Industry, February 17-20 at the Waldorf-Astoria Hotel, New York, will be the consideration that will be given for the first time to the preparation of specifications for non-fibrous raw materials.

At the first general session, John Traquair, general chairman of the TAPPI Raw Materials Division will outline the general plan of the Technical Association.

An open meeting will be held during the session of the Alkaline Pulping Committee on Monday afternoon, February 17, at which time the possibilities regarding the development of specifications for lime and saltcake will be discussed.

On Tuesday afternoon during the session of the Coated Paper Committee an open meeting will be held to discuss possible specification development for casein.

Buyers and sellers of these commodities are urged to be present and to enter into the discussion to guide the committee in their work on specifications. Representatives of the American Society for Testing Materials will be present to show how that organization has accomplished its work along similar lines.

Aluminum Adsorbents Do Not Infringe

ALUMINUM oxide adsorbents, including "Activated Alumina," sold by Aluminum Co. of America, do not infringe U. S. patents Nos. 1,335,348, 1,537,260, and 1,678,298, granted to Silica Gel Corp., when these adsorbents are used in the treatment of purification of gases, liquids, and oils, according to consent decrees entered in the U. S. District Court at Baltimore on Oct. 30, 1935. Two actions to determine this question were brought in the Federal Court at Baltimore by Aluminum Co. of America on May 28, 1935, under the Federal Declaratory Judgments Act.

Silica Gel Corp. and its receiver were named as defendants. While the suits were in progress the patents in question were sold by Silica Gel Corp. to The Davison Chemical Co., who intervened as defendants. The suits were settled when the Silica Gel Corp. and the trustees of The Davison Chemical Co. consented to final decrees by the Federal Court, holding that Aluminum Co.'s adsorptive aluminous products, of which "Activated Alumina" and "Alorco Adsorbent" are a type, do not infringe the patents in question.

CHEMICAL PRICES DECLINED, OIL VALUES ADVANCED LAST YEAR

FOR THE FIRST month of last year, the weighted index number for chemicals stood at 87.53. The number for December was 87.35 and the monthly average for the year was 87.42. These indexes give a good indication of the limited confines within which prices for chemicals moved during the twelve months.

With few exceptions, the chemicals of greatest importance from a tonnage standpoint maintained an unchanged position throughout the year. In the case of sulphuric acid, open quotations were repeated but trading was largely free from the price-cutting competition which had been in effect in the years immediately preceding and in that respect prices were stronger than the weighted index numbers would indicate but this would be offset by trading in other selections where private terms entered into transactions with the result that the actual sales figures were below the prices openly quoted.

Among the selections which registered net price gains during the year were: acetic acid, antimony oxide, acetate of lime, chlorine, bleaching powder, cobalt oxide, copperas, diethylene glycol, nickel salts, bichromates of soda and potash, nitrate of soda, tin salts, benzol, naphthalene, and casein. On the down side will be found: cream of tartar, lead oxides, phosphates of soda, zinc oxide, cresylic acid, rosin, turpentine, and shellac.

Phosphates of soda which had been under keen competitive selling for a long time, appeared to have reached a point approaching stability in the early part of the year but this condition was short-lived and this material in the latter part of the year was the outstanding example of price-cutting competition carried to a point where intrinsic values were disregarded, contracts for 1936 delivery having been reported as accepted at prices below the cost of production.

The unprecedented demand for chlorine last year had a strengthening effect on that market and contract prices for 1936 deliveries were marked up for both chlorine and bleaching powder. Conversely the increase in chlorine output at electrolytic plants brought about a surplus of caustic soda and prices for the latter at times were under pressure but this situation had righted itself by the end of the year.

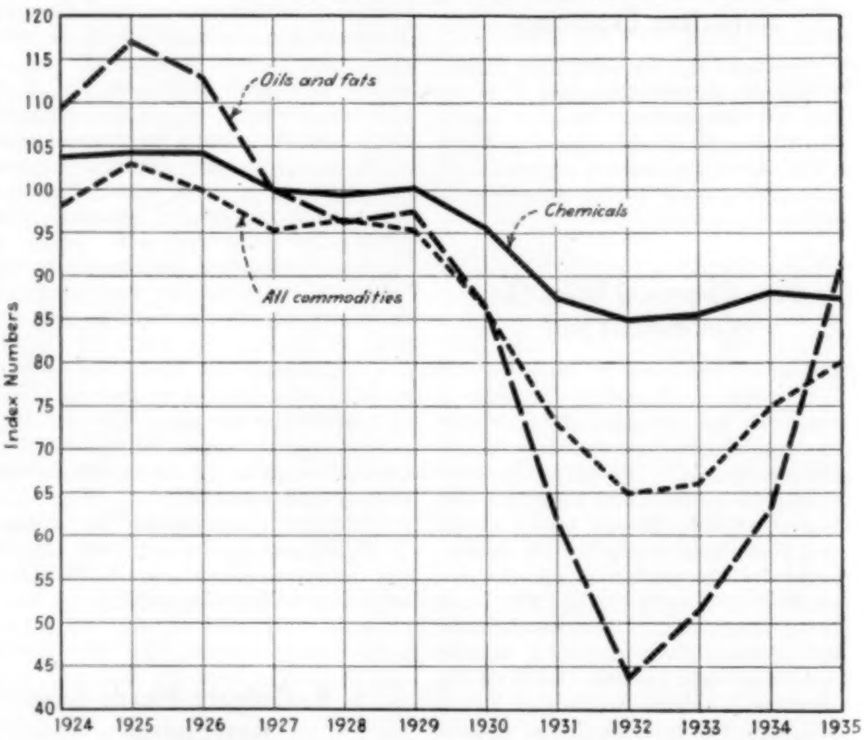
One of the most important price declines of the year was found in the case of the drastic cut announced for all grades of zinc oxide. This also was due to competitive influences and not to any lowering in the cost of production. In the first place, larger amounts of foreign material were coming on the market but of greater importance was the competition from domestic producers especially those who were making use of recovered zinc as a raw material.

The price trend for vegetable oils and animal fats was decidedly upward in the first quarter of last year with the high point of the year reached in March. The recovery in values for oils and fats over those ruling in 1934 is evident from the average monthly index numbers—that for 1934 being 63.14 and that for 1935 being 91.50. The rise in price in these markets was general, extending to practically every selection. Crude cottonseed oil by virtue of smaller production and good consuming demand was a leader in the price movement. Processing taxes was a bullish factor on some oils and foreign exchange aided materially in establishing record prices for China wood oil.

Yearly Indexes of Prices
(12-month average)

	Chemicals	Oils and Fats	All Commodities
1924.......	103.88	109.31	98.1
1925.......	104.41	117.12	103.5
1926.......	104.42	112.98	100.0
1927.......	100.00	100.00	95.4
1928.......	99.51	96.43	96.7
1929.......	100.10	97.55	95.3
1930.......	95.78	86.62	86.4
1931.......	87.61	61.90	73.0
1932.......	85.00	43.60	64.9
1933.......	85.58	51.48	66.0
1934.......	88.12	63.14	75.0
1935.......	87.42	91.50	80.0

Average Monthly Price Indexes, 1924-1935



CHEM. & MET.
Weighted Index of
CHEMICAL PRICES

Base = 100 for 1927

This month	**86.93**
Last month	87.21
February, 1935	87.60
February, 1934	88.37

The lowering in the weighted price index for the month was due largely to weakness in solvents. Denatured alcohol was reduced and spirits of turpentine established a relatively low average for the period. Cobalt oxide also was selling at a reduced figure.

CHEM. & MET.
Weighted Index of Prices for
OILS AND FATS

Base = 100 for 1927

This month	**91.29**
Last month	92.36
February, 1935	90.94
February, 1934	54.32

Vegetable oils showed a spotty condition with price movements in both directions. Crude cottonseed oil was higher than a month ago but the paint-making oils were lower. Animal fats also continued their downward trend.

Current PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Feb. 13.

Industrial Chemicals

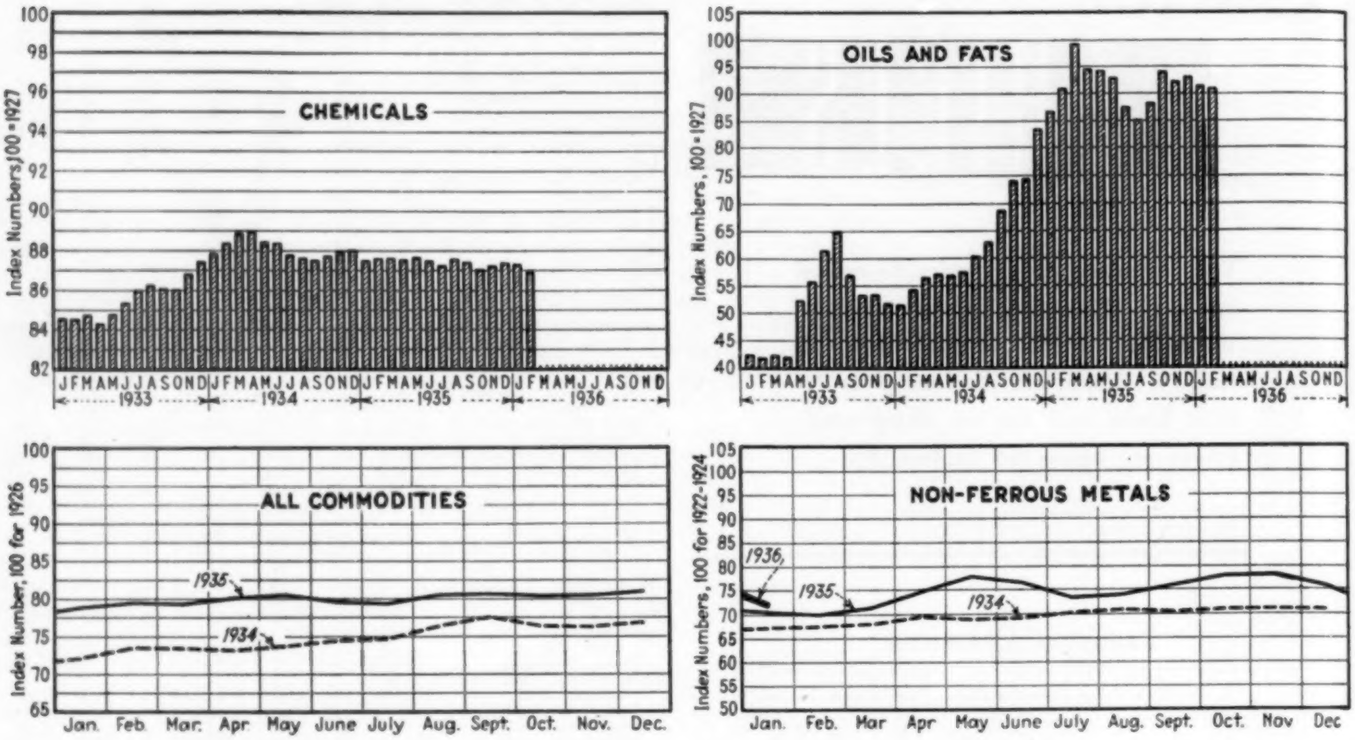
	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.12 -$0.12½	$0.12 -$0.12½	$0.12 -$0.12½
Acid, acetic, 28%, bbl., cwt	2.45 - 2.70	2.45 - 2.70	2.40 - 2.55
Glacial 99%, drums	8.43 - 8.68	8.43 - 8.68	8.25 - 8.50
U. S. P. reagent	10.52 -10.77	10.52 -10.77	10.52 -10.77
Boric, bbl., ton	105.00-115.00	105.00-115.00	95.00 -105.00
Citric, kegs, lb	.28 - .31	.28 - .31	.28 - .31
Formic, bbl., ton	.11 - .11½	.11 - .11½	.11 - .11½
Gallic, tech., bbl., lb	.60 - .65	.60 - .65	.60 - .65
Hydrofluoric 30% carb., lb	.07 - .07½	.07 - .07½	.07 - .07½
Lactic, 44%, tech., light, bbl., lb	.11½- .12	.11½- .12	.12 - .12½
22%, tech., light, bbl., lb	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks, cwt	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -......	18.50 -20.00
Oxalic, crystals, bbl., lb	.11¼- .12¾	.11¼- .12¾	.11¼- .12¾
Phosphoric, tech., c'bys., lb	.09 - .10	.09 - .10	.09 - .10
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Sulphuric, 66°, tanks, ton	15.50 -......	15.50 -......	15.50 -......
Tannic, tech., bbl., lb	.23 - .35	.23 - .35	.23 - .35
Tartaric, powd., bbl., lb	.24 - .25	.24 - .25	.24 - .25
Tungstic, bbl., lb	1.50 - 1.60	1.50 - 1.60	1.40 - 1.50
Alcohol, Amyl	......-......	......-......	......-......
From Pentane, tanks, lb	.15 -......	.15 -......	.143-......
Alcohol, Butyl, tanks, lb	.11 -......	.11 -......	.12 -......
Alcohol, Ethyl, 190 p'f., bbl., gal	4.27½-......	4.27½-......	4.15½-......
Denatured, 190 proof			
No. 1 special, dr., gal	.34 -......	.36 -......	.346-......
Alum, ammonia, lump, bbl., lb	.03 - .04	.03 - .04	.03 - .04
Chrome, bbl., lb	.04½- .05	.04½- .05	.04½- .05
Potash, lump, bbl., lb	.03¾- .04	.03 - .04	.03 - .04
Aluminum sulphate, com., bags cwt	1.35 - 1.50	1.35 - 1.50	1.35 - 1.50
Iron free, bg., cwt	2.00 - 2.25	2.00 - 2.25	1.90 - 2.00
Aqua ammonia, 26°, drums, lb	.02½- .03	.02½- .03	.02½- .03
tanks, lb	.02½- .02¾	.02½- .02¾	.02½- .02¾
Ammonia, anhydrous, cyl., lb	.15½- .16	.15½- .16	.15½- .16
tanks, lb	.04½-......	.04½-......	.04½-......
Ammonium carbonate, powd. tech., casks, lb	.08 - .12	.08 - .12	.08 - .12
Sulphate, wks., cwt	1.20 -......	1.20 -......	1.20 -......
Amylacetate tech., tanks, lb	.12 - .135	.12 .135	.142-......
Antimony Oxide, bbl., lb	.13½- .14	.14 .14¾	.10½. .10¾
Arsenic, white, powd., bbl., lb	.03½- .04	.03½- .04	.03½- .04
Red, powd., kegs, lb	.15¾- .16	.15¾- .16	.15¾- .16
Barium carbonate, bbl., ton	56.50 -58.00	56.50 -58.00	56.50 -58.00
Chloride, bbl., ton	72.00 -74.00	72.00 -74.00	74.00 -75.00
Nitrate, cask, lb	.08½- .09	.08½- .09	.08½- .09
Blanc fixe, dry, bbl., lb	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt	2.00 - 2.10	2.00 - 2.10	1.90 - 2.00
Borax, gran., bags, ton	44.00 -49.00	44.00 -49.00	40.00 -45.00
Bromine, cs., lb	.36 - .38	.36 - .38	.36 - .38
Calcium acetate, bags	2.10 -......	2.10 -......	2.00 -......
Arsenate, dr., lb	.06 - .07	.06 - .07	.06 - .07
Carbide drums, lb	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., del., ton	20.00 -33.00	20.00 -33.00	17.50 -......
flake, dr., del., ton	22.00 -35.00	22.00 -35.00	19.50 -......
Phosphate, bbl., lb	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb	.05½- .08½	.05½- .06	.05½- .06
Tetrachloride drums, lb	.05¾- .08½	.05¾- .06	.05¾- .06
Chlorine, liquid, tanks, wks., lb	2.15 -......	2.15 -......	2.00-......
Cylinders	.05½- .06	.05½- .06	.05½- .06
Cobalt oxide, cans, lb	1.29 - 1.35	1.39 - 1.45	1.25 - 1.30
Copperas, bgs., f.o.b., wks., ton	15.00 -16.00	15.00 -16.00	14.00 -15.00

	Current Price	Last Month	Last Year
Copper carbonate, bbl., lb	.08¾- .16	.08¾- .16	.08¾- .16
Cyanide, tech., bbl., lb	.37 - .38	.37 - .38	.37 - .38
Sulphate, bbl., cwt	3.85 - 4.00	3.85 - 4.00	3.85 - 4.00
Cream of tartar, bbl., lb	.16¾- .17	.16¾- .17	16¾- .17
Diethylene glycol, dr., lb	.16½- .20½	.16½- .20½	14 - .16
Epsom salt, dom., tech., bbl., cwt.	1.80 - 2.00	1.80 - 2.00	2.10 - 2.15
Imp., tech., bags, cwt	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Ethyl acetate, drums, lb	.08½-......	.08½-......	.08½-......
Formaldehyde, 40%, bbl., lb	.06 - .07	.06 - .07	.06 - .07
Furfural, dr., contact, lb	.10 - .17½	.10 - .17½	.10 - .17½
Fusel oil, ref. drums, lb	.16 - .18	.16 - .18	.16 - .18
Glaubers salt, bags, cwt	.85 - 1.00	.85 - 1.00	.85 - 1.00
Glycerine. c.p., drums, extra, lb	.14 - .14½	.14 - .14½	.14 - .14½
Lead:			
White, basic carbonate, dry casks, lb	.06½-......	.06½-......	.06½-......
White, basic sulphate, sck., lb	.06 -......	.06 -......	.06 -......
Red, dry, sck., lb	.07 -......	.07 -......	.06 -......
Lead acetate, white crys., bbl., lb.	.10½- .11	.10½- .11	.10½- .11
Lead arsenate, powd., bbl., lb	.09 - .10	.09 - .10	.09 - .10
Lime, chem., bulk, ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk., lb	.06 -......	.06 -......	.05 -......
Lithophone, bags, lb	.04½- .05	.04½- .05	.04½- .05
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.06 - .06½
Methanol, 95%, tanks, gal	.33 -......	.33 -......	.33 -......
97%, tanks, gal	.34 -......	.34 -......	.34 -......
Synthetic, tanks, gal	.35½-......	.35½-......	.35½-......
Nickel salt, double, bbl., lb	13. - .13½	.13 - .13½	.12½- .13
Orange mineral, csk., lb	.10 -......	.10 -......	.09 -......
Phosphorus, red, cases, lb	.44 - .45	.44 - .45	.44 - .45
Yellow, cases, lb	.28 - .32	.28 - .32	.28 - .32
Potassium bichromate, casks, lb.	.08½- .09	.08½- .09	.07¾- .08¼
Carbonate, 80-85%, calc. csk., lb.	.07 - .07½	.07 - .07½	.07 - .07¾
Chlorate, powd., lb	.08 - .08¾	.08 - .08¾	.08¾- .09
Hydroxide(c'stic potash) dr., lb.	.06¼- .06½	.06¼- .06½	.06¼- .06½
Muriate, 80% bgs., ton	22.00 -......	22.00 -......	22.00 -......
Nitrate, bbl., lb	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb	.18½- .19	.18½- .19	.18½- .19
Prussiate, yellow, casks, lb	.18 - .19	.18 - .19	.18 - .19
Sal ammoniac, white, casks, lb	.04½- .05	.04½- .05	.04½- .05
Salsoda, bbl., cwt	1.00 - 1.05	1.00 - 1.05	1.00 - 1.05
Salt cake, bulk, ton	13.00 -15.00	13.00 -15.00	13.00 -15.00
Soda ash, light, 58%, bags, contract, cwt	1.23 -......	1.23 -......	1.23 -......
Dense, bags, cwt	1.25 -......	1.25 -......	1.25 -......
Soda, caustic, 76%, solid, drums, contract, cwt	2.60 - 3.00	2.60 - 3.00	2.60 - 3.00
Acetate, works, bbl., lb	.04¾- .05	.04¾- .05	.04¾- .05
Bicarbonate, bbl., cwt	1.85 - 2.00	1.85 - 2.00	1.85 - 2.00
Bichromate, casks, lb	.06½- .07	.06½- .07	.05½- .06¾
Bisulphate, bulk, ton	15.00 -16.00	15.00 -16.00	14.00 -16.00
Bisulphite, bbl., lb	.03½- .04	.03½- .04	.03 - .04
Chlorate, kegs, lb	.06¼- .06½	.06¼- .06½	.06¼- .06½
Chloride, tech., ton	12.00 -14.75	12.06 -14.75	12.00 -14.75
Cyanide, cases, dom., lb	.15½- .16	.15½- .16	.15½- .16
Fluoride, bbl., lb	.07½- .08	.07½- .08	.07½- .08
Hyposulphite, bbl., lb	2.40 - 2.50	2.40 - 2.50	2.4C 2.50
Metasilicate, bbl., cwt	2.90 - 3.00	2.90 - 3.00	3.25 - 3.40
Nitrate, bags, cwt	1.275-......	1.275-......	1.24 -......
Nitrite, casks, lb	.07½- .08	.07½- .08	.07½- .08
Phosphate, dibasic, bbl., lb	.022- .023	.022- .023	.022- .024
Prussiate, yel. drums, lb	.11½- .12	.11½- .12	.11½- .12
Silicate (40° dr.) wks., cwt	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60-62%, dr., lb	.02¾- .03½	.02¾- .03	.02¾- .03
Sulphite, cyrs., bbl., lb	.02¾- .02½	.02¾- .02½	.02¾- .02½
Sulphur, crude at mine, bulk, ton	18.00 -......	18.00 -......	18.00 -......
Chloride, dr., lb	.03½- .04	.03½- .04	.03½- .04
Dioxide, cyl, lb	.06½- .08	.06½- .08	.07 - .07½
Flour, bag, cwt	1.60 - 3.00	1.60 - 3.00	1.60 - 3.00
Tin Oxide, bbl., lb	.51 -......	.52 -......	.56 -......
Crystals, bbl., lb	.37 -......	.36½-......	.38 -......
Zinc chloride, gran., bbl., lb	.05 - .06	.05 - .06	.05½- .06
Carbonate, bbl., lb	.09 - .11	.09 - .11	.09½- .11
Cyanide, dr., lb	.36 - .38	.36 - .38	.38 - .42
Dust, bbl., lb	.069- .07	.069- .07	.057- .07
Zinc oxide, lead free, bag, lb	.05 -......	.05 -......	.05¾-......
5% lead sulphate, bags, lb	.04¾-......	.04¾-......	.05¾-......
Sulphate, bbl., cwt	2.65 - 3.00	2.65 - 3.00	2.75 - 3.00

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb	$0.10 -$0.11	$0.10 -$0.11	$0.09¾-$0.10
Chinawood oil, bbl., lb	.14½-......	.14-......	.09¾-......
Coconut oil, Ceylon, tanks, N. Y. lb	.05 -......	.04¾-......	.05¾-......
Corn oil crude, tanks, (f.o.b mill), lb	.09½-......	.10 -......	.10½-......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.08¾-......	.08¾-......	.09¾-......
Linseed oil, raw car lots, bbl., lb	.098-......	.10 -......	.091-......
Palm, casks, lb	.04½-......	.04½-......	.04¾-......
Palm kernel, bbl., lb	.05¾-......	.05¾-......	nom.......
Peanut oil, crude, tanks (mill), lb	.08¾-......	.09 -......	.10½-......
Rapeseed oil, refined, bbl., gal	.55 -......	.56 -......	.47 -......
Soya bean, tank, lb	.08½-......	.08 -......	.08½-......
Sulphur (olive foots), bbl., lb	.08½-......	.08¾-......	.08 -......
Cod, Newfoundland, bbl., gal	.40 -......	.35 -......	.36 -......
Menhaden, light pressed, bbl., lb	.072-......	.072-......	.06 -......
Crude, tanks(f.o.b. factory), gal.	.36 -......	.36 -......	.28 -......
Grease, yellow, loose, lb	.05 -......	.05½-......	.05½-......
Oleo stearine, lb	.08¾-......	.09½-......	.10½-......
Red oil, distilled, d.p. bbl., lb	.09½-......	.09½-......	.07¾-......
Tallow, extra, loose, lb	.06½-......	.06¾-......	.06 -......

CHEM. & MET.'S WEIGHTED PRICE INDEXES



Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.62
Refined, bbl., lb.	.80 – .85	.80 – .85	.80 – .85
Alpha-naphthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.14½– .15	.14½– .15	.14½– .15
Aniline salts, bbl., lb.	.24 – .25	.24 – .25	.24 – .52
Benzaldehyde, U.S.P., dr., lb.	1.10 – 1.25	1.10 – 1.25	1.10 – 1.25
Benzidine base, bbl, lb.	.65 – .67	.65 – .67	.65 – .67
Benzoic acid, U.S.P., kgs., lb.	.48 – .52	.48 – .52	.48 – .52
Benzyl chloride, tech., dr., lb.	.30 – .35	.30 – .35	.30 – .35
Benzol, 90%, tanks, works, gal.	.18 – .20	.18 – .20	.15 – .16
Beta-naphthol, tech., drums, lb.	.24 – .27	.24 – .27	.22 – .24
Cresol, U.S.P., dr., lb.	.11 – .11½	.11 – .11½	.11 – .11½
Cresylic acid, 99%, dr., wks., gal.	.51 – .52	.45 – .46	.50 – .51
Diethylaniline, dr., lb.	.55 – .58	.55 – .58	.55 – .58
Dinitrophenol, bbl., lb.	.29 – .30	.29 – .30	.29 – .30
Dinitrotoluen, bbl., lb.	.16 – .17	.16 – .17	.16 – .17
Dip oil, 25%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, bbl., lb.	.38 – .40	.38 – .40	.38 – .40
H-acid, bbl., lb.	.65 – .70	.65 – .70	.65 – .70
Naphthalene, flake, bbl., lb.	.07 – .07½	.07 – .07½	.05½– .06
Nitrobenzene, dr., lb.	.08½– .09	.08½– .09	.08½– .10
Para-nitraniline, bbl., lb.	.51 – .55	.51 – .55	.51 – .55
Phenol, U.S.P., drums, lb.	.14½– .15	.14½– .15	.14½– .15
Picric acid, bbl., lb.	.30 – .40	.30 – .40	.30 – .40
Pyridine, dr., gal.	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Resorcinal, tech., kegs, lb.	.65 – .70	.65 – .70	.65 – .70
Salicylic acid, tech., bbl., lb.	.40 – .42	.40 – .42	.40 – .42
Solvent naphtha, w.w., tanks, gal.	.26 –......	.26 –......	.26 –......
Tolidine, bbl., lb.	.88 – .90	.88 – .90	.88 – .90
Toluene, tanks, works, gal.	.30 –......	.30 –......	.30 –......
Xylene, com., tanks, gal.	.30 –......	.30 –......	.26 –......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grid., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech., bbl., lb.	.15 – .16	.15 – .16	.11 – .12
China clay, dom., f.o.b. mine, ton	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.04 – .20	.04 – .20	.04 – .20
Prussian blue, bbl., lb.	.37 – .38	.37 – .38	.35½– .37
Ultramarine blue, bbl., lb.	.10 – .26	.10 – .26	.06 – .32
Chrome green, bbl., lb.	.26 – .27	.26 – .27	.26 – .27
Carmine red, tins, lb.	4.00 – 4.40	4.00 – 4.40	4.00 – 4.40
Para toner, lb.	.80 – .85	.80 – .85	.80 – .85
Vermilion, English, bbl., lb.	1.59 – 1.60	1.52 – 1.55	1.56 – 1.60
Chrome yellow, C. P., bbl., lb.	.12 – .14	.14 – .16	.15 – .15½
Feldspar, No. 1 (f.o.b. N.C.), ton.	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 – .08½	.07 – .08½	.07 – .08½
Gum copal Congo, bags, lb.	.09 – .10	.09 – .10	.06 – .08
Manila, bags, lb.	.09 – .10	.09 – .10	.16 – .17
Damar, Batavia, cases, lb.	.15½– .16	.15½– .16	.16 – .16½
Kauri No. 1 cases, lb.	.20 – .25	.20 – .25	.45 – .48
Kieselguhr (f.o.b. N. Y.), ton.	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc, ton.	50.00 –......	50.00 –......	40.00 –......
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 –...07
Imported, casks, lb.	.03 – .40	.03 – .40	.03 – .35
Rosin, H., bbl.	5.65 –......	5.65 –......	5.95 –......
Turpentine, gal.	.49½–......	.50½–......	.55½–......
Shellac, orange, fine, bags, lb.	.27 –......	.27 –......	.31 –......
Bleached, bonedry, bags, lb.	.24½–......	.23½–	.24 –......
T. N. bags, lb.	.14 –......	.14½–	.18 –......
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
300 mesh (f.o.b. Ga.), ton.	7.50 –10.00	7.50 –10.00	7.50 –11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 –......	13.75 –......	13.75 –......

INDUSTRIAL NOTES

THE TIMKEN STEEL & TUBE CO., Canton, Ohio, has promoted S. D. Williams to the position of director of sales. He formerly was manager of tube sales.

MICHIANA PRODUCTS CORP., Michigan City, Ind., has added Lloyd J. Bohan to its Chicago sales force with headquarters at 80 E. Jackson Blvd.

REPUBLIC STEEL CORP., Youngstown, Ohio, has moved its general offices to the former Medical Arts Bldg., recently renamed the Republic Bldg.

CENTRAL FOUNDRY CO., New York, has moved its Pacific Coast office from San Francisco to 278 Fourth St., Oakland, Calif.

POOLE FOUNDRY & MACHINE CO., Woodberry, Baltimore, Md., has added the state of Ohio to the sales area of its products handled by the Ladd Equipment Co., Pittsburgh.

HERCULES POWDER CO., Wilmington, Del., has transferred George C. O'Brien from Wilmington to the naval stores department of the New York office at 120 Broadway. Paul Mayfield, formerly manager of the Naval stores department at Chicago, succeeds Mr. O'Brien and G. Fred Hogg succeeds Mr. Mayfield at Chicago.

TRUEMPY, FAESY & BESTHOFF, INC., New York, has changed its name to Faesy & Besthoff, Inc. Robert A. Faesy and Silas Besthoff have been the sole principals since 1930.

TOLEDO SYNTHETIC PRODUCTS, INC., Toledo, Ohio, has changed its name to Plaskon Company, Inc.

THE TORRINGTON CO., Torrington, Conn., and its subsidiary, the Bantam Ball Bearing Co., South Bend, Ind., announce the appointment of A. S. Hellstrom as manager of the Cleveland, Youngstown, Akron, and Wheeling districts with offices in the Caxton Bldg., Cleveland.

DETROIT REX PRODUCTS CO., Detroit, has opened a branch office at 201 N. Wells St., Chicago, to handle sales in Wisconsin, Illinois and Missouri.

New CONSTRUCTION

Where Plants Are Being Built in Process Industries

	Current Projects		Cumulative 1936	
	Proposed Work	Contracts	Proposed Work	Contracts
New England..........	....	....	$964,000	....
Middle Atlantic........	$684,000	$37,000	3,972,000	$29,000
South..................	124,000	1,711,000	12,340,000	1,689,000
Middle West...........	1,117,000	....	13,477,000	137,000
West of Mississippi.....	5,060,000	2,120,000	12,333,000	463,000
Far West..............	40,000	30,000	4,017,000	1,500,000
Canada................	8,000,000	496,000	21,251,000	224,000
Total................	$15,025,000	$4,394,000	$68,354,000	$4,042,000

PROPOSED WORK
BIDS ASKED

Alcohol Factory — Allied Industrial Alcohol Corp., Kane and Van Brunt Sts., Brooklyn, N. Y., is having plans prepared by E. M. Wharff, Archt., c/o Owner, for altering its 7 story factory at 37 Irving St., Brooklyn. Estimated cost including equipment $37,000.

Alkali Factory — Mathieson Alkali Works, 2400 Buffalo Ave., Niagara Falls, N. Y., is receiving bids for an addition to its plant on Buffalo Ave. Estimated cost exceeds $37,000.

Chemical Factory — Merck & Co., Lincoln Ave., Rahway, N. J., plans improvements and additions to its factory. Estimated cost $40,000.

Chemical Factory—Rudemaker Chemical Co., Manistee, Mich., plans improvements and additions to its factory.

Glass Melting Furnace—Ford Motor Co., Dearborn, Mich., is receiving bids for furnishing and erecting a glass melting furnace in safety glass factory now under construction. Estimated cost $500,000.

Glass Factory—Owens Illinois Glass Co., 965 Wall St., Toledo, O., has acquired a factory at Boston and Linwood Aves., Baltimore, Md., and will improve same for its own use. Estimated cost $40,000.

Glass Factory—Owens Illinois Glass Co., 965 Wall St., Toledo, O., has acquired the plant formerly occupied by the Enterprise Can Co. on Chambers St., Pittsburgh, Pa., and will improve same for its own use. Estimated cost $40,000.

Factory—Johns-Manville Co., 22 East 40th St., New York, N. Y., plans improvements and alterations to its factory at Manville, N. J. Estimated cost $70,000.

Factory—Johns-Manville Corp., Gretna, La., R. B. Murphy, Supt., plans to construct a 1 story, 150x800 ft. factory.

Gas Plant—Municipality, Brewton, Ala., plans to construct a gas manufacturing plant. Estimated cost $50,000.

Gas Plant — Duke Power Co., Burlington, N. C., C. E. Scott, in charge, plans to construct additions to its gas plant here. Estimated cost $37,000.

Paint Factory — Glidden Co. of California, 1300 7th St., San Francisco, Calif., is having plans prepared by T. Ronneberg, Crocker Bldg., San Francisco, for an addition to its factory on 7th and Daggett Sts. Estimated cost including equipment $40,000.

Paint Factory—Sherwin Williams Co., 101 Prospect Ave., N.W., Cleveland, O., plans to construct an addition to its factory at East 115th St. and Cottage Grove Ave. Estimated cost exceeds $500,000.

Research Building — Cook Paint Co., 1412 Knox St., North Kansas City, Mo., is having plans prepared for the construction of a 4 story research building. Estimated cost $50,000.

Paper Mill — Hammermill Paper Co., Erie, Pa., plans to construct a paper mill and power plant. Estimated cost $500,000.

Paper Mill—Ontario Paper Co., Ltd., 480 McGill St., Montreal, Que., Can., plans to construct a paper mill on Comeau Bay, on the Manicougan River, Quebec. J. Stadler, 1117 St. Catherine St. W., Montreal, Que., Consult. Engr. Estimated cost $8,000,000.

Pulp and Fibre Mill—Champion Fibre Co., Canton, N. C., and Hamilton, O., plans to construct a pulp and fibre mill on the Houston Ship Channel in the vicinity of Houston, Tex. Estimated cost $3,500,000.

Polymerization Plant—Humble Oil & Refining Co., Houston and San Antonio, Tex., is having preliminary plans prepared by its engineering department for the construction of a polymerization plant at Baytown, Tex. Estimated cost $450,000.

Sugar Refinery—Holly Sugar Corp., Colorado Springs, Colo., contemplates constructing an addition to its refinery and installing equipment. Plans will be prepared by engineering department. Estimated cost $250,000.

Refinery—Eastern States Petroleum Co., Galveston and Houston, Tex., plans to construct a modern cracking plant on the channel between Galveston and Houston. Estimated cost $300,000.

Refinery—Phillips Petroleum Co., Bartlesville, Okla., plans to construct a natural gasoline casinghead gasoline plant at 30th and Kelly Sts., Oklahoma City, Okla. A. H. Riney, Bartlesville, Engr. Estimated cost $60,000.

CONTRACTS AWARDED

Beet Sugar Factory—Amalgamated Sugar Co., c/o American Crystal Sugar Co., Denver, Colo., plans to repair and alter its beet sugar refinery at Twin Falls, Idaho, which has been idle since 1933. Separate contracts have been awarded for the work. Estimated cost including equipment $37,000.

Cellophane Factory—Dobeckmun Co., 3301 Monroe Ave., Cleveland, O., manufacturer of cellophane, has awarded the contract for an addition to its factory to Bison Co., 12406 Marston Ave., Cleveland. Estimated cost $75,000.

Chemical Plant—Cincinnati Chemical Works, Norwood, O., awarded contract for constructing chemical plant at St. Bernard, O., to Meyer Hecht Co., 2824 Stanton St., Cincinnati. Estimated cost exceeds $40,000.

Chemistry and Pharmacy Building—University of Washington, Seattle, Wash., awarded contract for chemistry and pharmacy building to Sound Construction & Engineering Co., Northern Life Tower, Seattle, $376,524.

Chlorine Plant—Columbia Chemical Co., Barberton, O., awarded contract for constructing chlorine manufacturing plant to H. K. Ferguson Co., Hanna Bldg., Cleveland. Estimated cost $750,000.

Copra Oil Plant — El Dorado Oil Co., 230 California St., San Francisco, Calif., will construct a cocoanut and copra oil plant on the Inner Harbor at Oakland, Calif. Separate contracts. Estimated cost $45,000.

Distillery — James Distillery, Inc., 807 Key Highway, Baltimore, Md., awarded contract for constructing addition to distillery to State Bldg. Co., 36th St. and Roland Ave., Baltimore. Estimated cost $37,000.

Factory—General Dyestuff Corp., 230 Fifth Ave., New York, N. Y., awarded contract constructing 9 story factory on Hudson St., to Willton Construction Co., c/o Francisco & Jacobus, Archts., 511 Fifth Ave. Estimated cost exceeds $1,500,000.

Factory—Johns-Manville Co., 22 East 40th St., New York, N. Y., plans to construct addition to its factory at Waukegan, Ill. Work will be done by day labor and separate contracts. Estimated cost $150,000.

Factory—Liquid Carbonic Corp., 3100 South Kedzie Ave., Chicago, Ill., awarded contract constructing addition to factory to Kaiser Ducett Co., 80 East Jackson St., Chicago, Ill. Estimated cost $40,000.

Factory—Magnetic Pigment Co., 601 Cass St., Trenton, N. J., awarded contract for addition to its factory to N. A. Bugbee Co., 206 East Hanover St., Trenton. Estimated cost $25,000.

Factory—Michigan Paper Carton Co., Battle Creek, Mich., has awarded the contract for the construction of a factory for the manufacture of paper cartons to Murray Construction Co., Battle Creek. Estimated cost $30,000.

Kiln House—Carborundum Co., Buffalo Ave., Niagara Falls, N. Y., awarded contract for constructing kiln house to Walter S. Johnson Bldg. Co., Inc., 2532 Hyde Park Blvd., Niagara Falls.

Laboratory—Iowa State Board of Education, Des Moines, Ia., awarded contract constructing steam-gas laboratory at Iowa State College, Ames, to J. Thompson & Son, Albert Lea, Minn., $29,853.

Laboratory—University of Illinois, Urbana, Ill., A. C. Willard, Pres., awarded contract constructing medical and dental laboratories at University, to J. W. Snyder Co., 307 North Michigan Ave., Chicago, Ill., $964,860.

Laboratory—R. T. Vanderbilt Co., Inc., Winfield St., East Norwalk, Conn., awarded contract for laboratory to Genovese & Rich, Inc., 270 Atlantic St., Stamford, Conn. Estimated cost $37,000.

Lacquer Factory—Brevolite Lacquer Co., 20th St. and Sheridan Rd., North Chicago, Ill., awarded contract for addition to factory to Campbell, Lourie & Lautermilch, 400 West Madison St., Chicago, Ill. Estimated cost $50,000.

Paint Factory—Wettach Paint & Chemical Co., Carnegie, Pa., J. R. Stetler, Secy., has acquired the plant formerly occupied by H. L. Dixon Co. on Rosslyn Rd. and will rehabilitate, and enlarge same and install machinery and equipment for the manufacture of paints and chemicals. Separate contracts have been awarded for the work. Estimated cost $37,000.

Warehouse—American Distilling Corp., c/o W. E. Murray, 908 Hayes St., San Francisco, Calif., awarded contract constructing warehouses to Leibert & Trobock, Albert Bldg., San Rafael, Calif.

Warehouse—Olde Tyme Distillers, Inc., Cedarhurst, Md., awarded contract constructing 5 story warehouse to G. Walter Tovell, Eutaw and McCulloch Sts., Baltimore, $75,000.

TRENDS OF PRODUCTION AND CONSUMPTION